

# PUBLIC WORKS

CITY

COUNTY

STATE



## *In This Issue*

### **Bituminous Surface Treatments for Roads and Streets**

*Bernard E. Gray*

### **How Masonry Dam Was Built Over Geological Fault**

### **Mechanical Equipment in Sewage Treatment Works**

*A. Prescott Folwell*

### **Equipment Purchasing Practices and Rentals**

*C. N. Connor*

### **Incinerator Firing at Washington**

*Harrison P. Eddy, Jr.*

### **Practical Details of Concrete Construction**

*W. E. Barker*

MAY, 1933

# Applied soil stabilization

## OFFERS NEW TYPE LOW-COST ROADS

THIS emergency has developed an era of low-cost roads which has brought about a thorough study of stabilization of road materials by proper control methods.

Graded proportions of such road material as sand, gravel, clay, etc., mixed with Calcium Chloride, provide maximum durability with a smooth-riding surface.

Engineers are rapidly adopting these principles as applied to this type of construction to obtain the greatest benefit from their highway funds.

Today, economy is of first importance to all highway engineers. Reduced construction and maintenance budgets will provide more miles of this new type of low-cost surface construction.

Stabilize *your* traffic-bound roads with Calcium Chloride.

Calcium Chloride producers are now organizing a field technique and laboratory service section, for your convenience. For further particulars write today to any of the following members of the

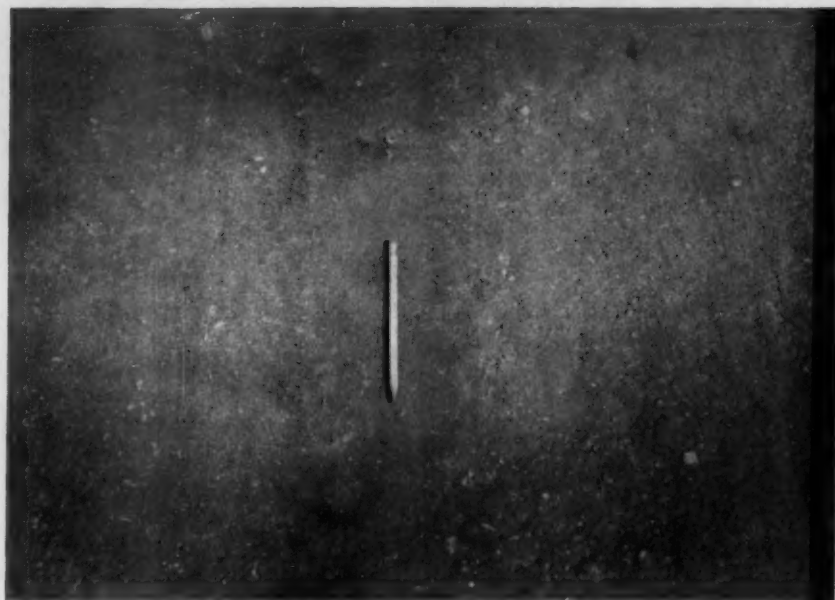
### CALCIUM CHLORIDE ASSOCIATION

SOLVAY SALES CORPORATION  
61 Broadway, New York City

THE COLUMBIA ALKALI CORP.  
Barberton, Ohio

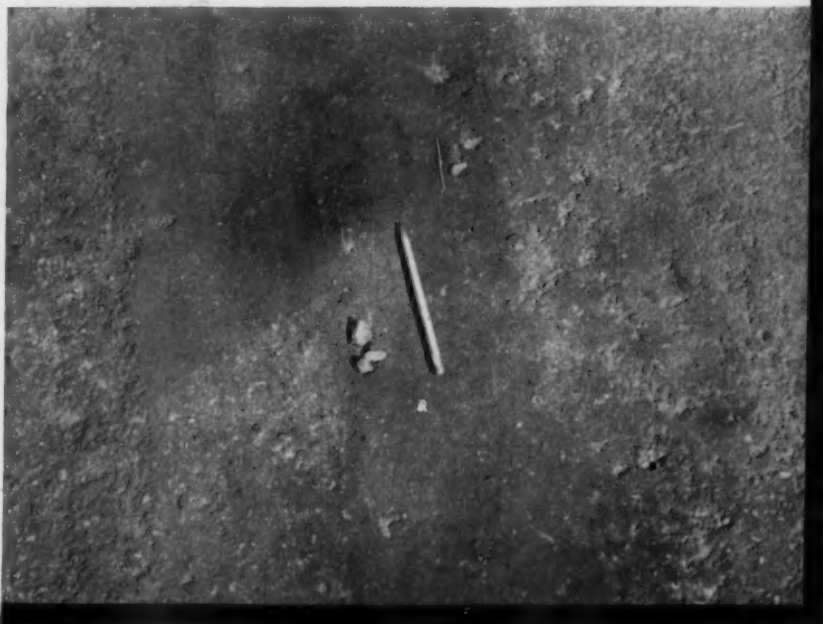
MICHIGAN ALKALI COMPANY  
10 East 40th St., New York City

THE DOW CHEMICAL COMPANY  
Midland, Michigan



- Close-up views of Stabilized Gravel Road, showing pencil impression on traveled way (above), taken one day and (below) seven days after maintenance. Note the surface durability evidenced by comparison of the impression.

*Photographs Copyright 1933, The Dow Chemical Co.*

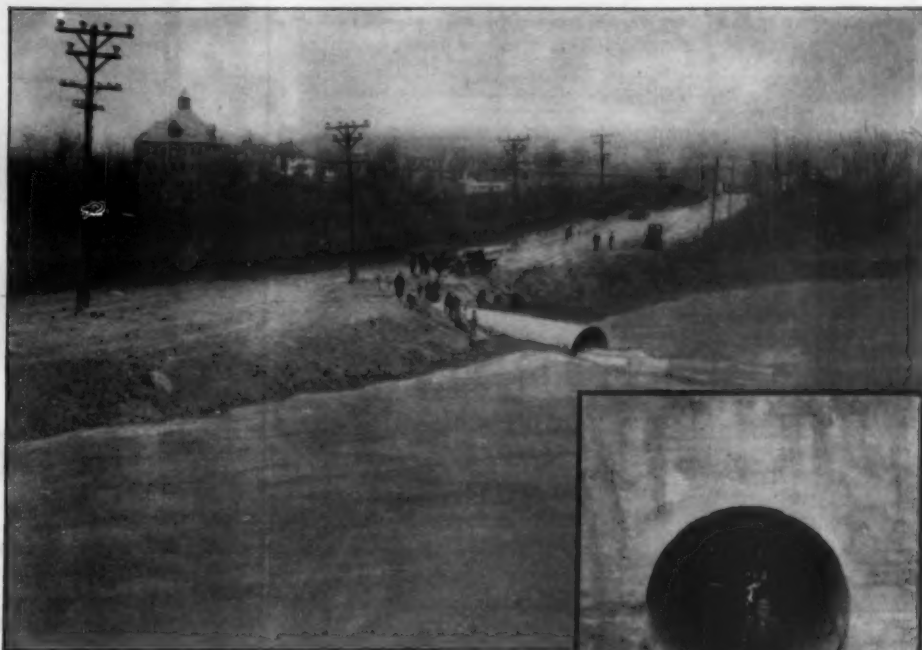


## CALCIUM CHLORIDE

### FOR COMPACTING ROAD SURFACES

# Here's the **STRENGTH** needed for **LARGE Storm Sewers**

**... and increased durability too!**



When you get into larger storm sewer structures, strength is doubly important—say engineers. And that's one reason why MULTI PLATE, developed by Armco Engineers, is winning rapid acceptance in the municipal field.

Either in full-round or in arches, Armco MULTI PLATE has the strength needed for large storm sewers. Thick plates mean long, low-cost service, too. Armco Ingot Iron, in much thinner gauges, has an actual service record of 27 years to date.

Consider these features—extra thick plates with giant corrugations that permit you to design and custom-build the kind of structure best suited to the job at hand.

These plates, punched and curved, are bolted together on the job by local labor, without special equipment. The result is a continuous structure having super strength, and endurance for the toughest kind of service.

But that's only part of the story. Let an Armco man show you how Armco MULTI PLATE may be adapted for various kinds of storm sewers, bridge replacements and other drainage structures that necessitate large sizes. Ask for the latest illustrated catalog. Use the coupon.

ARMCO CULVERT MANUFACTURERS ASSOCIATION . . . Middletown, Ohio

Other ARMCO Drainage Products

Perforated Metal Pipe  
Part-Circle Culverts  
Paved Invert Pipe  
Metal Cribbing  
Automatic Drainage Gates



This symbol on every section identifies genuine MULTI PLATE made from a product of The American Rolling Mill Company

## ARMCO MULTI PLATE

## Storm Sewers

- ☐ I would like to know more about Armco MULTI PLATE for storm sewers.  
☐ Send latest illustrated catalog.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

I am ☐ an Engineer ☐ Contractor ☐ City Official ☐ Student

PW-5

**MAIL TODAY**





**FRINK  
SNOW-PLOWS**

**CARL H. FRINK**  
MANUFACTURER

**CLAYTON 1000 ISLANDS NEW YORK**

DAVENPORT LOCO. FRINK SNOW-PLOWS  
& MFG. CORP. OF CANADA Ltd.  
Davenport, Iowa Toronto, Ontario

**LET THE  
GENERAL  
AND HIS STAFF**

SHOVEL - DRAGLINE - PULL-SHOVEL - CLAM-SHELL - CRANE - SKIMMER

*make your* **SPRING DRIVE** *a success!*

The BIG MACHINE! of its class.  
Speed? Yardage? Service? Yes! and plenty of it.  
Write for further information or a demonstration.  
*Distributors in principal cities*

**THE GENERAL EXCAVATOR COMPANY**  
MARION, OHIO, U.S.A.

**Hotstuf**  
TRADE MARK

**CONTRACTORS EQUIPMENT**  
Asphalt Heaters  
Surface Heaters  
Paving Tool Heaters and Tools  
Hi-Speed Trailer Tool Boxes

DISTRIBUTORS IN PRINCIPAL CITIES

**MOHAWK ASPHALT HEATER CO.**  
FRANKFORT NEW YORK

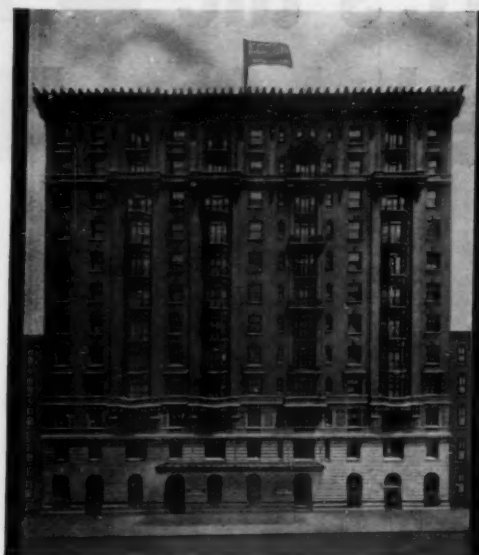
\*\*\*\*\*

## ON PAGE 43 .....

On page 43 you will find a special service department for readers of PUBLIC WORKS who want literature covering the very latest developments in equipment and materials used in the construction of public improvements.

\*\*\*\*\*

For latest catalogs, consult the *classified* INDUSTRIAL LITERATURE section—page 43.



## *In New York's most convenient and best known location*

AT THE EDGE of TIMES SQUARE  
... but a few steps from Broadway,  
within walking distance of theatres, shops  
and principal buying centers ... The  
Woodstock offers a location of unexcelled  
convenience for the visitor to New York  
City. And in addition there is unusual  
restfulness and charm about The Wood-  
stock ... in both public rooms and the  
large, airy, guest accommodations.

Popular priced restaurant.

SINGLE ROOMS and BATH from \$2.50  
DOUBLE ROOMS and BATH from \$4.00

*Special weekly and monthly rates  
upon application.*

## **HOTEL WOODSTOCK**

127 WEST 43rd STREET, NEW YORK CITY

*Under KNOTT Management*



# PUBLIC WORKS

An Engineering and Construction Journal

City

County

State

VOL. 64

MAY, 1933

No. 5

## TABLE OF CONTENTS FOR MAY, 1933

### Construction:

Practical Details of Concrete Construction. *By W. E. Barker* ..... 14

Editorial ..... 17

### General:

How One Public Works Department Got Four Hundred Inches of Favorable Publicity During 1932. *By William W. Reeder* ..... 7

### Highways and Pavements:

Suggested Methods of Repairing and Strengthening Old Bridges. *By Fred Kellam* ..... 8  
Ten Highway Commandments ..... 19  
Smoother Riding Roads and Longer Life. *By A. E. Stewart* ..... 20  
Bituminous Surface Treatments for Roads and Streets. *By Bernard E. Gray* ..... 21  
Surface Treatment on Gravel Saves Money. *By Robert S. Gain* ..... 23  
Equipment Purchasing Practices and Rentals. *By C. N. Connor* ..... 31  
Highway Work to End the Depression ..... 32  
Oil Mix Gravel Surfacing Using Loose Material. *By L. D. Townsend* .. 33  
Highway Guard Rails ..... 33

### Refuse Collection and Disposal:

Incinerator Firing at Washington, D. C. *By Harrison P. Eddy, Jr.* .... 18  
Seven Yard Refuse Collection Equipment for Baltimore ..... 34  
Costs of Street Cleaning in Cincinnati ..... 36

### Sewerage and Sewage Treatment:

Mechanical Equipment in Sewage Treatment Works. *By A. Prescott Folwell* ..... 11  
Sewer Rental and Compulsory Sewage Treatment in Ohio ..... 34  
Prechlorination of Sewage for Odor Control ..... 36  
Accident Hazards at Sewage Plants ..... 36  
Rehabilitation of Osage City Sewage Works ..... 36

### Water Supply and Purification:

How Masonry Dam Was Built Over Geological Fault ..... 9  
Small Up-to-Date Iron Removal Plant ..... 10  
The Water Wheel ..... 15  
An Inexpensive Iron Removal Plant. *By E. S. Flannery* ..... 34  
Activated Carbon in Missouri ..... 36

## PUBLIC WORKS

J. T. MORRIS  
President

Founded in 1896

SUMNER N. HUME  
New York, N. Y.

W. A. HARDENBERGH  
Vice-Pres. & Asso. Editor

A. PRESCOTT FOLWELL  
Editor

JOSEPH E. O'CONNOR  
Chicago, Ill.

CROXTON MORRIS  
Asst. Manager

Published Monthly  
at 310 East 45th St.  
New York, N. Y.

Western Office:  
154 E. Erie St.  
Chicago

### SUBSCRIPTION RATES:

United States and Possessions, Mexico and Cuba ..... \$3.00  
All other countries, \$4.00. Single Copies, 35 cents each.

## ??? Brainstorms ???

That's what Mr. Overing of Nebraska calls them, so we'll adopt that name for this month anyway. And here we might apologize for turning down some of the problems that come to us from our readers. Many of them are purely mathematical exercises—and most of us have too much such exercise in trying to add check-book balances that aren't there. So, hang your problem on good old Mikey and Ike or some one else that doesn't care and dress it up a bit. And remember, we can't print diagrams, pictures or other illustrations. So ———

### Here's How:

The pump problem was especially applicable last month, inasmuch as those heavy April rains flooded the editorial cellar. We hurriedly solved the problem, got the pumps on the job and had the situation well in hand in a short time. Now comes the contractor's profit. He remarked, in submitting his bid, that he expected a 10% profit, but that if he could reduce his costs 10%, he could make a 20% profit, and yet bid \$100 less on the job. How much did he bid? (Note: The question does not concern *when* he will be paid.)

### "Too Fast" is the Proper Answer:

Lately a new airplane record was established when an Italian pilot flew at the rate of more than 7 miles per minute. This record was made over a relatively short course and computation of the speed was relatively simple arithmetic. Suppose he had been able to fly 160 miles with the wind and back again in an hour and a half; and 240 miles with the wind and half way back again in an hour and a half. What would be the speed of the plane?

### Solutions from Last Month:

We want to congratulate H. S. Peck of Arkansas for solving that five-number twister. Says he: "The sum of  $a, b, c, d, e$  is  $250 - x$ . We know that  $a$  must equal 1, leaving four unknowns. The number sought is either odd or even. Assume it is even, then  $b$  is 2, and the last number is half the unknown number. Then  $c + d = \frac{1}{2}(250 - x) - 1 - 2$ .

There is now one more assumption quickly tried;  $d$  may be half of  $e$ , which would make  $c = 4$ , or twice the second factor.

Then  $\frac{1}{4}(250 - x) = \frac{1}{2}(250 - x) - 1 - 2 - 4$

Solving, we have  $x = 222$ , the desired sum is  $250 - x$ , or 28, and the factors are 1, 2, 4, 7, and 14". This shows clear thinking and is well done. Another who came through with a fine solution was our old friend Walter S. Wheeler of New Hampshire. He employed factors representing ordinates of a straight line equation.

Greek mathematicians called such numbers with properties such as this one perfect numbers. What a few of our solvers called this problem is something else again.

To solve the pump problem, let  $x$  be the unknown quantity,  $p$  the capacity of each pump,  $q$  the rate of infiltration and  $V$  the amount of water in the diggings when filled.

$$6(2p) = V + 6q$$

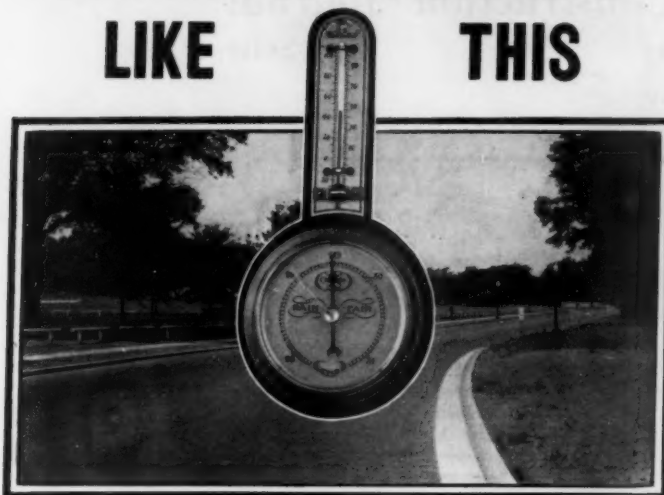
$$2(4p) = V + 2q$$

$$\frac{1}{2}(xp) = V + \frac{1}{2}q$$

from which the required number of pumps, 13, is found by solving for  $x$ . A sequel to the problem is: "What would be the effect of continuously running one pump?"

BENJAMIN EISNER.

## WEATHER CANNOT DESTROY PAVEMENT LIKE THIS



**T**HE practical road-building experience of the past 15 years shows weather to be an important governing factor in the true cost of a pavement.

Many leading authorities now consider a pavement's ability to resist weather equally, or even more important, than ability to resist traffic wear. For weather affects all pavements regardless of the lightness or heaviness of the traffic.

A brick pavement surface has far greater immunity to weather damage than any other commonly used paving material. It is denser—less absorbent. It is not opened by expansion and contraction; it does not soften under intense heat. Age does not change or weaken its structure. And as for traffic wear, nothing on wheels can damage it.

For these reasons, brick pavements continue to establish all records for long life and low upkeep.

For further information write National Paving Brick Association, 1245 National Press Building, Washington, D. C.

---

### PAVE and RESURFACE WITH BRICK

---



## 60% to 80% Savings in Fuel Costs

**O**WNERS of Diesel-Powered Sterlings are reporting savings of 60 to 80% in fuel costs. These savings alone are sufficient to pay for the entire original cost of the equipment in less than two years time under most types of operation.

Owing to the simple construction and operation of Diesel engines further economies are effected in maintenance and hauling costs, making them most profitable to own and operate.

*The Sterling line of Diesel-Powered trucks is complete, embodying a unit for every conceivable heavy duty hauling requirement. You are invited to call at the nearest Sterling branch, or write for detailed information.*

**STERLING MOTOR TRUCK COMPANY**  
MILWAUKEE, WISCONSIN

## ASPHALTS

**for ROOFS and ROADS**

**Road Oils and Cut-backs**

**All made from selected  
SMACKOVER (Arkansas) CRUDE**

Physical properties and quality equal to  
the best Mexican Asphalts

*Quotations furnished in drums or insulated tank cars.*

**MACMILLAN PETROLEUM CORP.**  
El Dorado, Arkansas

## JAEGER PUMPS

SURE PRIME  
2" to 6" SIZES

**\$165<sup>00</sup>**

buys 10,000 Gal.  
Size Complete

Write for new  
catalog, new  
low prices to  
The JAEGER  
MACHINE  
CO.  
400 Dublin Ave.  
COLUMBUS, O.



# PUBLIC WORKS

*City, County and State Engineering and Construction*

Vol. 64

May, 1933

No. 5

## How One Public Works Department Got Four Hundred Inches of Favorable Publicity During 1932

By William W. Reeder

*Assistant Engineer, Bureau of Public Works, Upper Darby Township, Pa.*

*We have received several letters expressing agreement with the article "How to Get Public Appreciation of Efficient Engineering Work" in our April issue. Their general thought was that the matter is as important as any technical features of the work of a public official, and one which should be considered seriously and not as a mere side issue. Among the letters was one from North Darby, Pa., which so interested us that we asked Mr. Reeder to tell us how he obtained 400 inches of favorable publicity in the local papers during 1932. The following is his reply:*

THE fact that engineers are probably the world's worst publicity agents probably accounts for the surprise attending the discovery of the news value possessed by the activities of the Public Works Department of the largest first class Township in the State of Pennsylvania, with a population of over 60,000.

The meetings of the Board of Commissioners are attended by representatives of three local papers and the Philadelphia press. When bids are to be opened, blue-line prints are prepared showing the names of those who have taken out specifications, and leaving blanks for the insertion of the bid. At one letting, more of these forms had been prepared than were needed, and the reporters were given copies. As a result, it was found that when the newspaper men could get the bids without much effort, and were sure of the spelling of bidders' names, they were glad to print the bids.

Monthly reports of departments become history when buried in the minutes, and reporters are interested in news, not history. Therefore copies of monthly reports and new ordinances are distributed to the press at the close of meetings, are news, and are printed. Such reports should be written in popular style and technicalities omitted as much as possible.

Weekly newspapers pay their correspondents ten to twenty cents an inch for local items, but they have found that news of municipal activities have a more general appeal to their readers than most other items and cost them nothing. Each week several "shorts" should be prepared which the papers can use to fill out at the ends of columns; they will be more than glad to get this material.

At the adoption of the annual budget, each commis-

sioner of this township is furnished with a graphic chart showing the relation of each department's appropriation to the whole. These are also furnished to the press and printed. Any charts or plans furnished to the press should be in such form as to be easily reproduced. This will always be appreciated.

Annual reports should be written with the sole idea of placing the Department favorably before the public, and tabulations and unit costs omitted as far as possible. The reports will thus receive extensive publicity, which should be one of their objects. Taxpayers are entitled to all the information they can be given, but that information must be readable.

Great care must be taken in preparing material for publication to omit personalities. Always use the third person. If the press gets the idea that someone is seeking personal publicity, their columns are closed to you. Wherever possible, proper names should be omitted and titles used. A favorable public opinion of the Department should be the only object.

With this object in mind, all employees must be directed to give the greatest consideration possible to the general public. Courtesy and tact are demanded. Impress employees with the fact that the public opinion of the Department is influenced by their actions while engaged on municipal work. Word-of-mouth publicity is as important as printed matter, and when unfavorable is harder to combat.

There are many other avenues open for placing an engineering administration before the public, and the engineer who seeks them out and uses them to their fullest extent is doing his municipality a real service.



# Suggestions for Repairing and Strengthening Old Bridges

By Fred Kellam

Assistant Chief Engineer, Indiana State Highway Commission

OF THE many old bridges in service on state and county highways, built at various times and according to various ideas of design and construction, very few were ever designed to bear the heavy loads of today. Also, these bridges have been exposed for years to the ravages of time, wind, and weather, floods and fire, decay and rust, freezing and thawing, and above all, the hammering and battering of traffic, and very few have wholly escaped some damage from one or more of these agencies of destruction. Considering these things, we find that the problem of determining the load capacity of old bridges and making repairs to restore or improve them presents an almost infinite variety of questions in detail. But the early replacement of all our weak and crippled bridges would overtax our resources under the most favorable conditions, and under the present economic situation it is more than ever necessary that we patch up our old bridges and make them serve as well as we can until funds become available for replacing them.

The change in traffic in recent years has resulted in much heavier concentrations of load, but smaller increases in the total load for which trusses are designed. Consequently, in old steel truss bridges, the stringers are almost invariably the weakest part of the bridge; although occasionally the floor beams or floor beam hangers or connections are the limiting point, and more rarely some member or connection of the truss.

Because of these facts, we have for some years used a simple formula for roughly calculating the probable safe load capacity of steel bridges. This formula is as follows:

$$L = \frac{267S}{l_s} \text{—Where}$$

L is the gross truck load in Tons—40% on each rear wheel.

S is the section modulus of the steel stringer in inches<sup>3</sup>.

l is the stringer span in feet, and

s is the stringer spacing in inches.

This formula is based on a stress of 16,000 pounds per square inch for steel. The result should be doubled if the maximum load which will not cause permanent damage is desired. This formula disregards the weight of the floor and floor system, which makes very little difference in stringers under normal conditions, but for heavy floors and long stringer spans the dead load should be figured.

For the reasons set out above, one of the most common bridge repairs is replacement of the floor or floor system. If the stringers are to be replaced with stronger ones, the other elements of strength of the bridge should be studied carefully and no money wasted in making the stringers stronger than the rest of the bridge. Also, the floor should not be greatly increased in weight unless it is certain that the floor system and trusses are sufficient to carry it. A number of bridges have been overstressed or even broken down by the weight of a concrete floor, when the bridge would have been quite satisfactory if a lighter floor had been used.

One very important matter to consider in a bridge floor is impact, and its closely related companion, vibration. In the White River bridge west of Martinsville, an experimental section of laminated floor was installed. This floor was four inches thick, while the old double plank floor was six inches thick, leaving a two-inch offset at the point where the two types joined. One panel of stringers next to this offset was bent down from two to six inches by the impact resulting from this condition, while the others were in excellent condition.

If one of the truss members of a bridge is damaged, the repair or replacement of the member is largely a matter which any good mechanic can work out. Care should be taken to see that bolt or rivet holes are not so located as to weaken the repaired member and that the repair does not throw the stress badly off the line of the member. The big problem is to keep the bridge from falling down while the repair is being made. Usually the safest, simplest and cheapest way is to put a bent under each floor beam to support the bridge while the truss member is out of service. Sometimes one or two such bents will do, but this may be risky unless the distribution of stresses in the truss under these conditions is carefully investigated, and the overstressed members strengthened. In the reconstruction of the Wabash River bridge on State Road 34 at Covington, traffic was carried on a truss span which was strengthened and supported at the first panel point while an abutment was torn out and a pier built in its place.

In many cases, if live loads are kept off the bridge, a temporary member may be used to permit the removal and replacement, or the repair, of the member without removing it. This was done in repairing a damaged hanger in the Broad Ripple bridge over White river on State Road 31. In repairing the double intersection truss bridge over the Wabash river on State Road 1 at Bluffton, where several compression verticals were buckled, the cost of falsework would have been excessive, but these members were straightened in place all at once by specially designed clamps and beams and without the use of falsework. The clamps and straightening beams were left in place, resulting in members stronger than when they were built, though rather clumsy in appearance.

A discussion of this subject would not be complete without reference to one rather common mistake. When a bridge as a whole shows signs of weakness, it is only natural to think of putting an additional support in the middle of the span. In the case of slab, beam or girder bridges, this is a very effective device for strengthening the structure, but in the case of truss bridges, it may even have the opposite effect. A rather simple stress analysis will show, unless certain members are reinforced or new ones added, that under some conditions a simple pratt truss with an extra support at the center of the span may actually fail under a concentrated load which it would safely carry without the center pier.

The above is abstracted from a paper before the 19th Annual Purdue Road School.

# How Masonry Dam Was Built Over Geological Fault

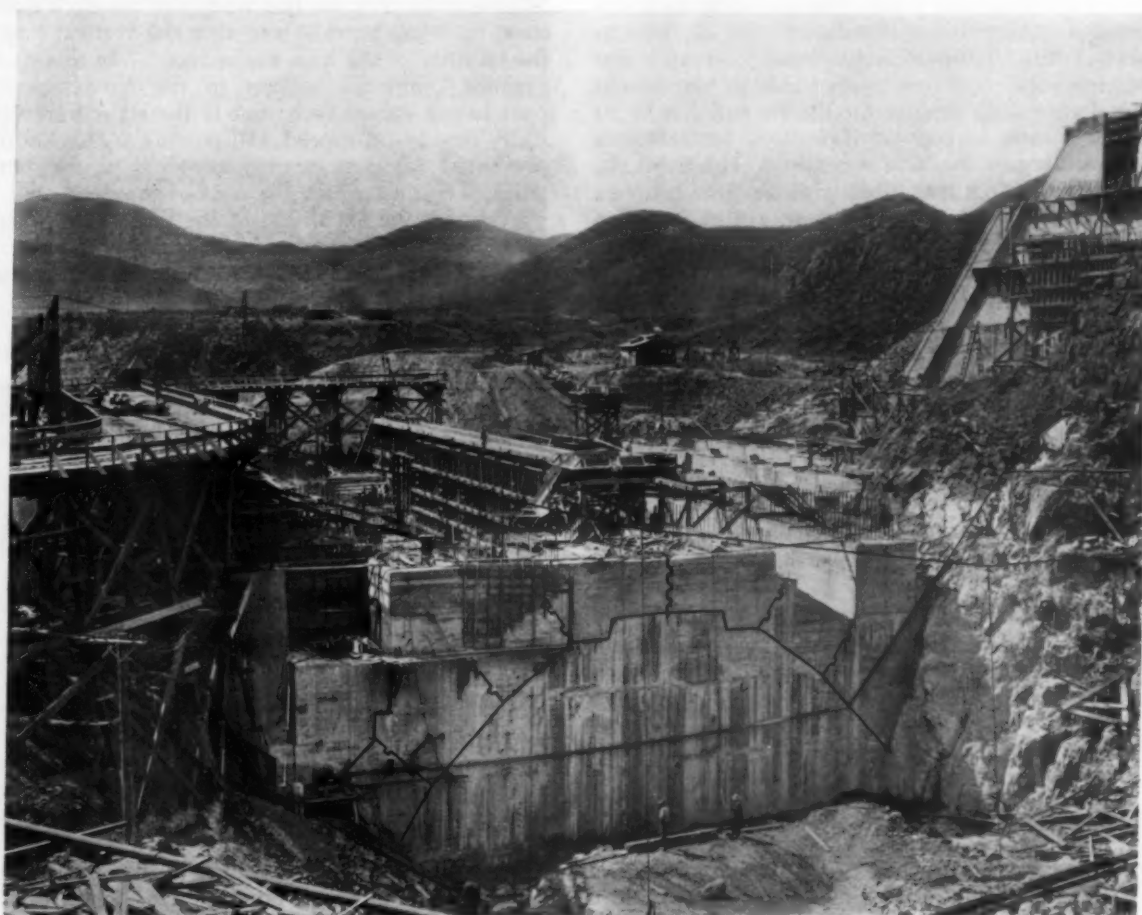
*Fault in foundation spanned by arch. Concrete cut-off wall 300 feet deep.  
Higher than any other Ambursen type dam yet built.*

THE Rodriguez dam, in Southern California only a few miles from the United States, is especially interesting for several reasons: It is higher than any dam of the Ambursen type yet built; four of the buttresses are supported on an arch which spans a fault in the rock foundation; the principal cut-off wall across the fault extends 300 feet below the stream bed; and there are other less spectacular reasons.

This dam is being built in connection with the project for furnishing a water supply for the municipality of Tijuana, which has a population of 10,000, and for irrigating 5,000 acres in the valley of the Tijuana river. The dam is on this river about 11 miles above the city. The drainage area above it is 938 square miles. Flood flow at the dam site has been known to reach 70,000 second-feet and it is believed that 150,000 is possible. On the other hand, the flow may be insignificant for periods of five to seven years. (The editor has walked across the river at Tijuana without getting his shoes even damp.) Therefore large storage capacity is necessary, and this dam will hold back 36 billion gallons—enough for ten years' consumption by

the municipality; while an average yield of 8 million gallons per day continuously is believed to be a safe estimate. The dam will have a maximum height of 187 feet above the stream bed and 240 feet above the lowest part of the foundation, and will be about 1900 feet long. The spillway will have a capacity of 150,000 second-feet.

The unusual structural features are due to the geological conditions at the dam site. It is in a gorge with a minimum width at the stream bed of about 100 feet, and 750 feet wide 130 feet higher, above which the slope is fairly flat. The rock is rhyolite except at the eastern part of the eastern slope, which is granite; the rock being fused along the contact, whence no leakage through the joint is expected. But a geologic fault about 20 feet wide extends along the easterly margin of the stream bed; and the surface rock over the entire bed is broken and a considerable part of it disintegrated. This condition was learned by making nine borings in the stream bed and 52 test pits on the side slopes, by the excavation for the foundation, and by a geologic examination of the site.



Rodriguez dam under construction. Joints of foundation arch shown by ink lines. Buttress nearing completion at the right; others started on top of arch.



Considering these conditions and the possibility of earthquakes, the problem of ensuring stability of a high dam there and preventing leakage through the fault under the dam was a difficult one, and was studied by Charles P. Williams for the J. G. White Engineering Corporation, A. J. Wiley, and F. L. Ransome and Paul Waitz, consulting geologists, the latter representing the National Commission of Irrigation of Mexico. The engineers considered rolled earth-fill dams, rock-fill, hydraulic-fill or combinations thereof; and concrete, including gravity, single arch, multiple arch, round head buttress, and Ambursen. The Ambursen is more flexible than any other type of concrete and was selected by the U. S. Bureau of Reclamation for somewhat similar conditions at Stoney Gorge; and in 1928 the territorial government contracted with the Ambursen Dam Co. for a dam of this type.

The plans provide for buttresses spaced 22 feet centers, 19 inches thick at the top, battering to a base thickness of the highest buttress of 66 inches, with an up-stream slope of one to one and a down-stream slope of one horizontal to 5 vertical. These support deck slabs with thicknesses varying from 25 inches at the top to 64.5 inches at the stream bed. In each of the three bays which come in the stream bed is a 5 x 5-foot sluice gate operated by a hydraulic cylinder. Water is drawn for service through two 30-inch cast iron pipes elevated about 30 feet above the stream bed, each controlled by a 30 x 24-inch Johnson needle valve and a 30-inch emergency gate valve; below which they join into one 36-inch cast iron pipe, in which is a venturi meter.

#### *The Foundation*

Four of the buttresses would come where the rock was of doubtful quality for a foundation, two of them in the main fault. To meet this difficulty, an arch was sprung from the solid rock on one side to that on the other and extending longitudinally the full length of the buttress base, to support these four buttresses in case of yielding of the rock beneath it. However, the space under the arch was filled with concrete made in massive articulated blocks and these are expected to transmit the load to the stream bed, the arch coming into play only in case the bed should settle. The surface of contact between these blocks and the intrados of the arch was finished smooth and coated with oil to prevent adhesion. The arch span varies from 79 to 95 feet with a 26 to 28-foot rise, and is 6 to 7 feet thick at the crown and 9 to 10 at the haunches.

To partly offset the pressure on the top of the arch caused by the stream below the dam during flood, when the stream may stand 15 feet above the arch, ducts filled with very porous mortar connect the down-stream pool with all parts of the intradosal surface.

The intradosal blocks rest on a foundation mat of concrete of 2 feet minimum thickness, transverse cut-off trenches 2 feet wide by 3 feet deep and spaced 25 feet centers first having been excavated across the fault and the adjacent rock of poor quality. Transverse key ways were constructed in the upper surface of the mat and in the top surfaces of all blocks, to prevent them and the arch from moving down stream.

#### *The Cut-Off Wall*

Excavation for the cut-off trench was carried by open cut 26 to 33 feet below the original rock surface, or 69 to 76 feet below the stream bed. At that depth bracing and otherwise maintaining this had become so difficult

that another method was employed for the remaining depth. The trench was filled with concrete in which ten shafts were left, and the remaining excavation continued below the concrete. The cut-off wall was 150 feet long where construction through the shafts was begun. About 130 feet lower the wall was 80 feet long. Part of the wall has been carried to a depth 213 feet below the stream bed. At the fault it is intended to carry the wall to a depth of 300 feet, at which depth the percolation factor will be 5.

When final depth is reached at any part of the wall, grout holes are drilled at 10-foot intervals in two rows 5 feet apart, carried 25 feet deep and grouted. The rock east of the east end of the wall will be similarly grouted from horizontal holes at least 50 feet long. The amount of water entering the cut-off trench and pumped out has rarely exceeded 2 second-feet.

#### *The Buttresses*

The buttresses are being constructed in a manner not heretofore employed, the construction joints being continuous and following the trajectory of the maximum principal stresses at full load. Each construction section is made with alternately long and short blocks, the latter about 5 feet long, the former not more than 35 feet, with a few exceptions up to 40 feet. The buttresses are reinforced throughout with bars parallel to the deck, all lapping of bars coming in the 5-foot blocks, which are constructed not less than 30 days after the longer blocks, which have this time to cool and shrink, thus minimizing the effect of such shrinkage on the total length of the complete section.

Another detail not before used is a device for preventing the deck slabs from sliding down the buttresses. If free to do this, the full weight of the deck does not come upon the buttress and thus the vertical load and the stability of the dam are reduced. In this dam the greatest computed tension in the buttresses is 78 pounds per square inch; but if the slabs were free to slide, this would exceed 150 pounds. This sliding is prevented by constructing keyways in the buttress tongues against which the ends of the deck abut. To provide for the expansion of the deck slabs when not protected from sunshine by the water of the reservoir, strips of cork-wood 1 to 1½ inches thick are inserted in the keyways along the upper edges.

Work was begun by the Ambursen Dam Co. in April, 1928, and fair progress made until the fall of 1930, but revolutions, the financial depression and other causes have caused interruptions since then, and comparatively little is being done now to effect the completion, the cost of which is about \$2,000,000.

#### *Small Up-to-Date Iron Removal Plant*

The village of Plymouth, O., in December, 1932, put into service an up-to-date plant for treating its well water supply, which was high in iron. The water is obtained from two 8-inch wells 84 and 62 feet deep, respectively, each pumped by a motor-driven turbine pump with a capacity of 260 g.p.m.

The iron removal plant consists of an aerator located above the roof of the main pumping and filter house, and three filters which receive the aerated water and discharge it into a clear water reservoir of 100,000 gallons capacity. This plant, which produces clear water of excellent sanitary quality, cost \$30,000, including two wells with pumps, high-service pumps, electric power line, and 8-inch pipe line from plant to village.



# Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell  
Editor, PUBLIC WORKS

## XII—General Operating Equipment and Addenda to Previous Chapters

### Laboratory Equipment

Methods of chemical and bacteriological analysis recommended for use in the sewage treatment plants of Michigan by the Engineering Bureau of the Michigan Dept. of Health and the Michigan Sewage Works Operators Association, are described in a pamphlet issued this year by the Michigan Engineering Experiment Station. This contains the following list of apparatus required; some of it is not needed in a plant with only primary treatment.

**Chemical Analysis:** For small village plant with part-time operator—1 Hydrogen ion apparatus; 2 Imhoff cones; 12 bottles, glass stoppered, 250 cc.; 3 Nessler tubes; 2 pipettes, 1 cc.

For plants employing part-time chemist or operator able to make routine tests add the following:—1 analytical balance, Sens. 0.1 mg., with set of weights 1 mg. to 100 gms.; 1 drying oven; 1 water bath, gas or electric; 1 Imhoff cone; 1 dissolved oxygen sampling can; 2 beakers, low form, 1 liter, and 2 of 250 cc.; glass stoppered bottles, 6 of 1 liter, 3 of 500 cc. and 12 of 250 cc.; 1 1-liter wash bottle; 1 50 cc. burette; 2 Meker type burners; 2 Bunsen burners; 1 burette clamp; 2 pinch clamps; 1 cork borer and bag of assorted corks; 4 Gooch crucibles, 25 cc., and 2 holders for same; graduated cylinders, 2 1-liter, 1 100 cc. and 1 25 cc.; 1 desiccator, 250 mm.; 4 evaporating dishes, 75 mm.; 1 file; 4 Erlenmeyer flasks, 300 cc.; 1 volumetric flask, 1 liter, and 1 100 cc.; 1 lb. of 7 mm. glass tubing; 3 pipettes, 1 cc., 1 of 100 cc., 2 of 1 cc. graduated 1/100, and 2 of 10 cc. graduated 1/10; 2 spatulas, 3 inch; 1 medium iron support; 36 assorted test tubes; 2 thermometers, 10 to 110; 1 crucible tongs, 2 in.; 2 wire gauze, 4 x 4 in.; 2 suction flasks, 500 cc.; 24 ft. 3/4 in. rubber tubing; 1 bag of assorted rubber stoppers; 1 desiccator plate, 230 mm.; 2 water suction pumps; 1/2 lb. of 6 mm. glass rods; 2 medium tripods; 1 Soxhlett flask, 150 cc.

For plants employing a full-time chemist, many of the above quantities are increased and the following added: Trip scales and a set of weights, 1 to 1,000 gms.; muffle furnace with rheostat; incubator, 20°; nitrogen distillation apparatus; gas analysis apparatus; 2 2-liter beakers, low form; 2 low form beakers, 600 cc. and 2 of 50 cc.; 6 beaker covers, 75 mm.; 2 condenser clamps and clamp holders; 1 condenser; 6 crucibles, 46 mm.; 2 evaporating dishes, 90 mm.; filter paper; 2 volumetric flasks,

500 cc. and 4 of 250 cc.; 6 funnels, 65 mm. and 1 Buchner funnel, 80 mm.; 4 Kjeldahl connecting bulbs; pipettes, 1 cc., 5 cc., 10 cc., 25 cc., and 50 cc., 2 of each; 6 4-in. iron rings; 2 thermometers, 0 to 250; 4 Kjeldahl flasks, 500 cc.

For bacteriological tests, in addition to the above: An incubator, 37°; an autoclave; hot air sterilizer; 2 platinum needles; 24 petri dishes; 144 Durham test tubes; Erlenmeyer flasks, 12 of 200 cc., 12 of 500 cc. and 6 of 1,000 cc.; pipettes, 24 of 1 cc. graduated 1/100 and 24 of 10 cc. graduated 1/10; 3 wire baskets; a lens, 3 1/2 magnifying.

This equipment is obtainable from any laboratory supply houses such as E. H. Sargent of Chicago and Eimer and Amend of New York. Comparators are special features of Hellige, Inc. (using color glass standards); La Motte Chemical Products Co., and Rascher & Betzold (using liquid indicators); W. A. Taylor & Co. (Enslow slide chlorimeter). La Motte also makes a sludge testing set, developed by Dr. Willem Rudolfs; and a B. O. D. set. A special B. O. D. bottle is made by E. J. Callahan & Co.

A similar list has been recommended by the New Jersey Sewage Works Association which agrees with the above in general, but adds, among other minor articles, a 1-liter pyrex washing bottle, 48 wide-mouth bottles, 2 maximum thermometers, a 9 x 12 electric hot plate, 2 1/2 in. watch glasses; and omits trip scales, muffle furnace, Kjeldahl flasks and Soxhlett flask.

### Gas Masks and Gas Detectors

Chlorine compressed into liquid form under about 100 pounds pressure becomes, if the pressure is removed, a gas very corrosive to metals and exceedingly painful and even fatal if breathed into the lungs. It sometimes happens, generally through carelessness, that a leak develops in chlorinator equipment, most often between the container and the chlorinator; and this should be stopped at once. For this purpose it is desirable to keep on hand (*not* in the room with the chlorinators) a gas mask. A simple hose mask with about 25 feet of hose (the intake end of which would be kept outside the danger room) would suffice where no chlorinator is more than 20 feet from a window or door. Such a mask, complete, costs about \$35. For this and other purposes where a longer hose is required, a blower is needed to force the air through the hose; which, with 25 additional feet of hose, would add about \$50 to the cost. Or oxygen-breathing apparatus, without hose, can be obtained for about \$150 with half-hour capacity. (These are list prices of the Mine Safety Appliances Co.)

It is sometimes necessary to enter digestion tanks or others which are roofed over and in which sewage digestion gases may collect, which gases it is difficult



Hose mask      Oxygen breathing apparatus



La Motte sludge testing set



Hellige "aqua" tester

to remove altogether. Workmen entering such tanks have been poisoned in some cases, blown up in others. It is desirable that gas masks be used for such work. At least, one man wearing a mask should make sure of the absence of gas before the others enter.

To determine whether explosive or oxygen-deficient gas is present in tanks (or in sewers, sewer manholes, or elsewhere), a gas detector can be used—an appliance provided with a long tube of copper, the end of which is dropped into the tank or sewer, an aspirator bulb by which the gas is sucked through the tube into a bomb provided with a spark plug, and valves, etc., for adding measured amounts of pure air. To test for carbon monoxide alone, the Bell Telephone Companies use a carbon monoxide detector ampoule which is lowered into the manhole by a cord or length of wire, its discoloration indicating the amount of  $\text{CO}_2$  present.

### Additions to Previous Chapters

The following items have come to our attention since the appearance of the subjects to which they severally apply. They are published here with a view to bringing the entire series up to date.

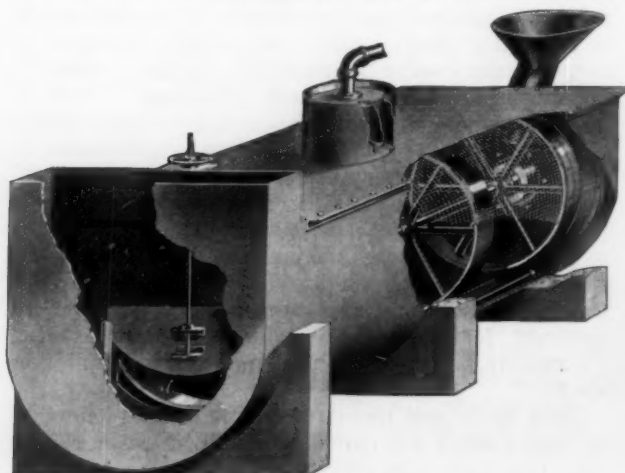
#### I—Grit Chambers and Bar Screens

<sup>1</sup>Grit or silt from grit chambers is removed in some plants by eductors (such as are used for cleaning catch basins); in other plants, by means of sand dredges. Where it is discharged through bottom openings, monitors (large nozzles attached to hose) are used to flush it out.

<sup>2</sup>Another mechanically cleaned screen of the third type is the "Schofield," made by the Municipal Sanitary Service Corporation. A modification of this, used where headroom is limited, has a reciprocating mechanism by which the rake, on reaching the horizontal position, drops directly to the bottom of the screen instead of revolving continuously in one direction.

In a number of plants, the coarse screen has the form of a basket of wire or rods with a mesh 1 inch or more square, into which the sewage is discharged and, flowing out, leaves coarse matters inside the basket. The basket is raised at intervals, by hand or crane, emptied and returned. The basket should of course be made of heavily galvanized wire or of non-corrosive metal.

A self-cleaning screen which can be used as either a coarse or fine screen consists of a series of screen



The PFT Screenings Digester

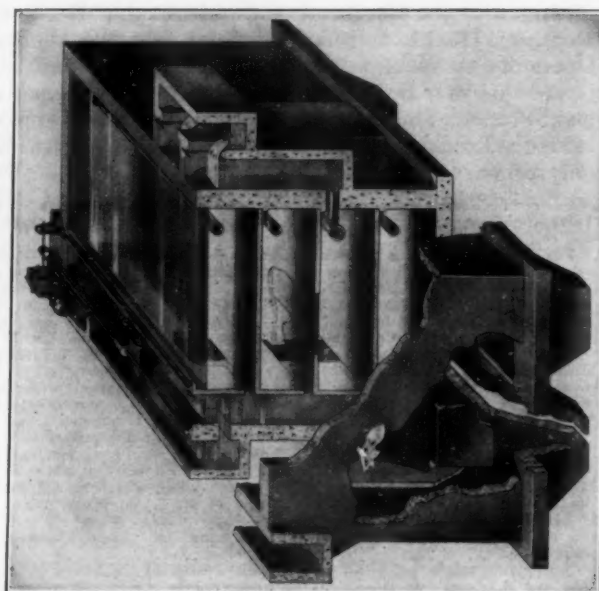
units hinged onto a pair of endless chain conveyors so that successive screens slightly overlap while rising through the sewage. As each screen unit passes over the top sheave, it falls forward and strikes a bumper, thereby loosening the solids retained on them, which fall into a bucket or conveyor. This, called the Laughlin travelling screen, is made by the Filtration Equipment Corporation.

#### III—Disposal of Screenings

<sup>1</sup>A special tank has been designed for digesting screenings, known as the P.F.T. screenings digester, consisting of a horizontal steel cylinder  $7\frac{1}{2}$  to 11 ft. long and 4 to 5 ft. diameter, inside of which revolves a drum of wire screening or perforated metal, to prevent the accumulation of dense scum, release entrapped gases and prevent local accumulation of acids. Provision is made for utilizing the gas evolved.

#### IV—Sedimentation Tanks

Mechanism for continuous removal of sludge has not been used in the ordinary two-story tanks, but a special



Pacific Flush Tank Tray Type Clarifier

design has been built at Rochester, N. Y., in which a modified Imhoff and digestion tank combined is obtained by building two circular tanks, one above the other; the upper being a sedimentation tank, the lower a digestion tank. A single shaft extends through the center of both tanks, carrying plows which sweep the solids from the floor of the upper tank to a central opening, through which they fall into the lower tank; while plows in the lower tank move the sludge to a central sump, from which it is removed by hydrostatic pressure in the customary way, and other plows at the top of this tank (which is also the floor of the upper tank) break up the scum and move the gas to outlets around the circumference of the tank, from which it is piped to a gas holder. This equipment was made by the Dorr Co.

A multiple-story tank has been brought out by the Pacific Flush Tank Co. which consists of three or four shallow sedimentation tanks, one above the other. A sludge scraper moves slowly back and forth over each floor, scraping the sludge from all into a common sump at each end of the structure.

### V—Activated Sludge Treatment

Single-stage piston compressors are seldom used, but several plants use centrifugal compressors or Nash "Hytor" compressors. Positive pressure blowers, such as the Connersville, Root, Needham, etc. are suitable for this work.

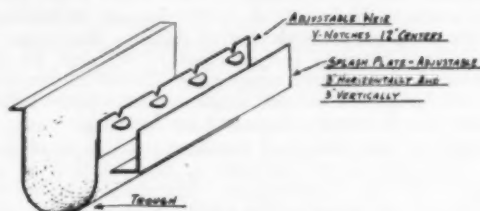
### VII—Oxidizing Beds

The Link Belt Co. makes a distributor for rectangular trickling filters, called the "automatic reversing distributor," which consists of a trough which extends across the bed, each end carried on a truck, which travels from end to end of the bed, forward and back, continuously discharging the sewage. A channel paralleling one side of the filter bed receives the sewage and a siphon attached to the trough siphons the sewage continuously from channel to trough. The sewage flows through V notches in one side of the trough, onto a horizontal spreader plate under each notch, and from these onto an angle, from the edge of which it flows in a continuous thin sheet onto the bed. Power for driving the motor which moves the trough is taken from an overhead trolley wire.

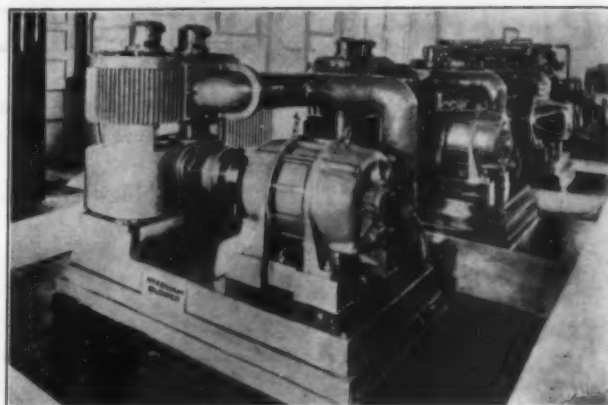
### VIII—Disposing of Sludge

#### Pressure Filters

What is believed to be the earliest mechanical treatment of sludge was by the pressure filter. They were in common use thirty or forty years ago in connection with chemical precipitation and a few plants still use them. The Berrigan press consists of 6 to 50 cast iron plates, dished on both sides and supported on a frame in a vertical position, face to face, each face covered with cloth such as 11 oz. army duck. The plates are forced together and sludge is pumped into the lenticular spaces between adjacent cloth-covered plates with a pressure of 80 to 100 pounds, which forces the liquid between the pores of the cloth, when it drains away



Trough of travelling distributor



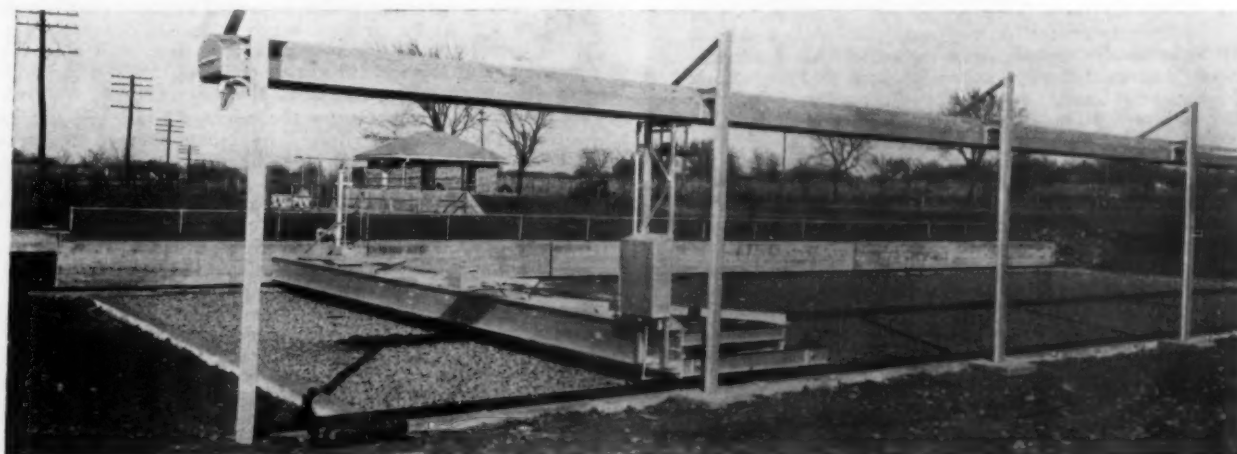
Three Needham Blowers in Morristown, N. J., plant deliver air for activated sludge treatment.

through channels in the faces of the plates. The sludge cake is solid enough to be handled like loam.

The Worthington press is similar in principle. Bags, 50 more or less, of 8 oz. to 12 oz. burlap are hung in a frame face to face between drainage sheets, are filled full of sludge, and the water squeezed out by pressing the bags together between large platens.

A vacuum filter, called a Genter filter, was used in experiments conducted in 1932 by the Baltimore Bureau of Sewers. This removed 18 to 20 lbs of dry solids per sq. ft. of filter area per hour, using 10 to 12 lb. of ferric chloride per 100 lb. of dry solids, at a cost of \$4 to \$5 per ton of dry solids (of which 55 to 65% was for coagulant), including all materials and labor and interest and depreciation on plant, including the building. The Genter filter consists of 20 vacuum tubes with a combined filter area of 16 sq. ft., equally spaced around the periphery of a 30 in. diameter circle and secured at one end to a spider. The spider, with the tubes, revolves in a tank of such depth that 8 tubes are immersed at a time. Each tube is a cylinder 3 in. in diameter and 18 in. long, surrounded by a woolen or metal cloth or other filtering medium, through which the liquid sludge was drawn by vacuum applied to the tubes while they were immersed; while momentary application of air pressure loosened the cake for removal; which was effected by two long blades which were revolved around the tube when it was in position for removing the cake.

(To be continued)



Traveling trough distributor on Link-Belt trickling filter at Osage City, Kans.



# Practical Details of Concrete Construction

By William E. Barker

Highway Engineer, Portland Cement Association

## XI—Need for and Methods of Curing

THE term "curing" is generally understood to mean the protection given concrete to assure proper hardening.

The hardening of cement is a chemical change known as hydration which occurs when the cement comes in contact with water. For proper hydration, sufficient moisture and heat must be present to produce the chemical change. The change occurs rather slowly, so proper temperatures must be maintained and moisture kept in contact with the cement for several days to secure good hydration.

Tests indicate that a concrete which has been allowed to dry out in the air of the laboratory, and therefore has had insufficient moisture for proper hydration, is about half as strong as identical concrete which has been kept wet during the hardening period. There is not as great a difference in strength as this between cured and uncured concrete exposed to common field conditions, because the outdoor air is more moist than that of the laboratory and the uncured concrete is aided by occasional rains. The strength of properly cured outdoor concrete is, however, about one-third greater than that of concrete which has not been properly cured.

Properly cured concrete is also more watertight, and therefore more durable, than concrete that has dried out too soon. The greater watertightness is caused by the swelling of the cement particles, with increased hydration, until they fill more and more of the pores in the concrete, decreasing percolation.

Plastic concrete contains ample moisture for hydration of all the cement particles, but if the concrete is exposed to the rapid evaporation induced by the dry air of the laboratory or the action of wind and sun, insufficient moisture will be left for proper hydration. The problem is, then, not to get more water into the concrete, but to so protect it from evaporation that the moisture already there is retained. It is during the first few hours after concrete is placed that the moisture can most readily escape and it is during this period that protection is most important.

The most common means of preventing evaporation is to apply a moist covering to the freshly laid concrete. Because burlap can be placed over partly hardened concrete without marring the surface, it is frequently used for preliminary curing. For horizontal surfaces, like pavements, sidewalks and floors, the burlap is usually removed after the surface has hardened sufficiently to permit the application of some cheaper material. A 2-inch layer of earth, sand, or sawdust, a 5 or 6-inch layer of hay or straw, or ponds of water are most commonly used to replace the burlap. Whatever the covering may be, it is kept wet by sprinkling through the curing period, which usually lasts from 7 to 14 days. Further curing would still increase the strength and durability somewhat, but in most cases these increases would not be sufficient to warrant the additional expense involved.

Where water under pressure is readily available, sprinkling from nozzles which throw a spray over the concrete surface is frequently economical.

Waterproof coverings which prevent evaporation of moisture from the slab have proved fairly efficient curing agents. The most common of these is waterproof paper, which is laid on the surface as soon as possible after the concrete has been placed and kept there until the end of the curing period. A paper strengthened by the inclusion of rope fibers is most popular for this purpose.

Several types of bituminous paint have been used successfully



Curing a concrete pavement with ponds of water held in place by earth dykes

for preventing evaporation. These are usually sprayed on the surface immediately after the final finishing operation and are left in place until they are worn or weathered away. Bituminous materials are black, and black has the well known property of transforming light rays into heat, increasing the temperature of the concrete beneath during daytime, with a corresponding increase in volume. At night, when the temperature of the concrete falls to that of the uncovered concrete, there is a corresponding shrinkage. Since this ab-

normal volume change occurs before the concrete is strong enough to resist high shrinkage stresses, abnormal shrinkage cracking results. This has been overcome by applying a coating of whitewash to the black covering.

During the early hardening period, monolithic concrete which is cast in forms has its moisture retained by the forms. After the forms are removed, further curing is frequently accomplished by covering the surface with burlap which is kept wet by sprinkling. Floors in structures are commonly cured with wet burlap or wet sand.

In freezing weather such work as paving is discontinued, since it is not practicable to protect this type of construction from low temperatures. The construction of structures, however, may frequently be continued throughout the winter months if proper curing temperatures are assured by adequate protection.

Temperatures higher than +50 degrees Fahrenheit are favorable to the proper hydration of cement. Hydration occurs rather slowly between temperatures of 40 and 50 degrees Fahrenheit and is almost completely arrested at temperatures below 40 degrees. Concrete freezes at 32 degrees Fahrenheit and concrete is usually damaged by freezing.

Heating of materials, and blanketing which is adequate to retain that heat in the concrete, is best adapted to prevent damage from low temperatures. Materials may be warmed by equipping the mixer with a torch which raises the temperature in the drum, or they may be heated before being put in the mixer.

The mixing water can readily be heated by passing it through a coil of 1½ to 2-inch pipe which is surrounded by a fire. The specific heat of water is high, hot water will raise the temperature of the other materials considerably, and for moderate temperatures this may be all the heating that is required.

For very low temperatures the aggregates also should be heated. They may be heated by piling them over pipes in which fires are kept burning, by steam pipes inserted in storage piles or bins, or by steam jets released in the aggregates. There is some danger that aggregates piled over pipes in which fires are built will become unsound from over-heating.

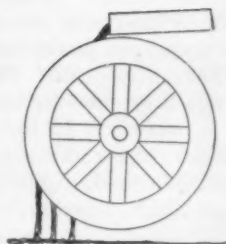
Concrete should not be heated to more than 120 degrees, as higher temperatures during the hardening period cause considerable reduction in strength.

After the concrete is in the forms, the heat which it contains should be retained. This is accomplished by covering the outside of the forms with blankets of straw held in place by burlap. Or the structure may be entirely encased in wood or canvas and the temperature inside kept high enough for proper hydration by means of fires within the structure.

The application of artificial heat to concrete causes it to dry out rather rapidly, making proper moist curing especially important when heat is being used.

# THE WATER WHEEL

*FOLLOWING are the essential features of the important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted. Published every month to include articles appearing during the preceding month.*



**C****CROSS CONNECTIONS** between potable and non-potable, or safe and unsafe, water supplies have been under consideration by water works and health authorities for the past ten years. A committee to report upon the subject was appointed by the American Water Works Assn. in 1930, and reported and its report was approved this year by the Committee on Water Works Practice.<sup>75</sup> It found that 18 of the states prohibit cross connections and 19 permit them only when they are protected in an approved way.

Protection is afforded by double check valves if all bronze and rubber seated which, if "properly installed and maintained are the best single protective device yet developed." Also "The automatic start and stop chlorinator is a valuable auxiliary protective device available for those installations where some further protection is felt necessary."

The committee recommended that no new cross connections be permitted, and that existing ones be eliminated except that they may, under extraordinary circumstances be permitted temporarily if properly protected by double check valves; also that elimination be encouraged by correcting deficiencies in pressure or reliability of public supplies; that bypasses around purification plants and emergency intakes be eliminated; and that attempts be made to establish national plumbing regulations which will prevent improper plumbing installations which would afford opportunities for local pollution.

Recording valve locations by angles rather than by distances alone has been worked out by A. H. Miller for Sheboygan, Wis.<sup>66</sup> "The basic idea is to locate the valves within or near any intersection by measured distance from a hub or set-up station (generally a catch basin curb), together with the an-

gular departure from an established line of sight from this hub to some other fixed object on the intersection" (generally the catch basin curb on the diagonally opposite corner). For measuring the angle in the field, a tripod is used carrying a circular plate 12 in. diameter, graduated to degrees, and a revolving arm carries a movable sighting point. This plan is said to "meet the requirements satisfactorily."

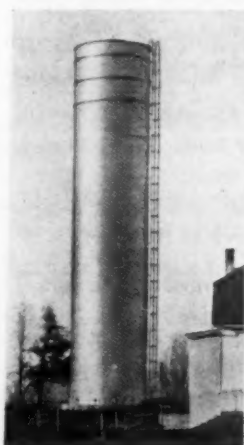


*New Colonial design elevated tank built for the city of Tallahassee, Fla. Capacity 400,000 gals.*

*Elevated water tanks* have received considerable attention recently,<sup>32, 40</sup> chiefly from the architectural viewpoint. These have involved the working out of new ideas in structural design, as distinguished from the ornamental attachments and enclosures of the past. Recently a new construction method has entered the field—butt-welding of the tank plates as a substitute for riveting. A butt-welded standpipe was recently constructed at Lititz, Pa.,<sup>41</sup> 23 ft. diameter and 110 ft. high. The plates were all squared up so as to fit perfectly and the edges planed in preparation for welding.

*Mud deposits in filters* are believed<sup>63</sup> to be "caused by the compacting of dirty sand grains into masses due to the improper washing of the beds. This is particularly true when fine sand is used as a filtering medium. Utilization of sand at least 0.5 mm. diameter, together with high velocity washing of the bed to give a 40-50 per cent expansion, if practical with existing plant design, will maintain clean beds free of mud deposits.

"Where mud balls exist, the beds may be cleaned by the use of caustic soda solutions, applying about one pound per square foot of bed and allowing it to stand for about three days with periodic raking. Subsequent



*Butt-welded standpipe at Lititz, Pa.*



washing will produce clean beds." Various mechanical methods also have been suggested.

*Ammonia-chlorine* treatment has not yet been thoroughly standardized and there are some major as well as minor details of its use upon which general agreement has not been finally reached. One of these has been referred to by Wm. J. Orchard<sup>74</sup> as follows: "Most discussions of the treatment have warned the operator against the installation of the ammonia-chlorine process where the time interval between treatment and the first consumer would not permit of sufficient contact to overcome this lag [in velocity of sterilization]. We now find that, with the exception of such installations as are used for the prevention of chloro-phenol tastes, it is quite feasible—in fact, one might say desirable—to treat with chlorine first, perhaps at rates considerably higher than normal, and subsequently "detaste" and stabilize the chlorine residual with the addition of ammonia. In this way, adequate sterilization having been effected with the introduction of the heavier chlorine dosages, the addition of the ammonia creates chloramines with all of their advantages and yet does not prohibit the immediate use of the treated water."

The germicidal effectiveness of chlorine, bromine and iodine has been compared by Beckwith and Moser<sup>70</sup> in extensive laboratory experiments. The effectiveness of chlorine being well established, it was used as a standard of comparison. Iodine has been used in military and camp sanitation but there had been little knowledge concerning bromine. In summarizing their investigation, the authors said: "Applications of as little as 0.1 p.p.m. of each were followed by marked lethal efficiencies. Numerous spore producers thus must have been eradicated. When the comparative germicidal values of chlorine, bromine and iodine upon *B. coli* are considered, each is found to reveal high potency, but of these three, bromine appears to be most effective since 0.25 p.p.m. of this element gave higher percentage efficiency kill than did either of the other two under the conditions of these experiments. . . . Residual bromine may be shown to be present after sixty minutes from time of application of initial concentrations of one part per million in the water used by us."

*Dominick-Lauter's* methylene blue brom cresol purple broth as a culture medium for determining the colon-aerogenes group is considered by Nolte and Kramer,<sup>73</sup> from comparison with the "Standard Methods" and Noble's broths, to be superior to the others with unfinished water and far superior with finished, being simplest, quickest and most reliable; and they hope its use will be adopted as a standard procedure.

*Blood worms and iron bacteria* heaped trouble on trouble for the engineer of the water company of Stockton, Calif.<sup>67</sup> It began with the collapse of the roof of the 1.8 m.g. reservoir in July, 1931. As uncovered well water is apt to breed several kinds of trouble, copper sulfate was applied, and nothing happened that year. But next spring complaints suggested draining and cleaning the reservoir, and the walls were found to be literally covered with blood worms (larvae of the *Diptera Chironomus*), and they abounded on the bottom, at places in dense masses of squirming bodies. The reservoir was cleaned, sterilized and refilled. But in spite of this the blood worms returned in September. Meantime, in June, iron bacteria developed in the reservoir so that the clear water was turned almost black; this being attributed to the failure to give the custom-

ary copper sulphate treatment. Such treatment, however, failed to remove the trouble, but chlorine applied in doses of 0.25 to 0.30 p.p.m. cured the trouble in a few hours and prevented its recurrence. It did not, however, deter the blood worms from their return engagement in September; in fact, feeding them chlorine in the laboratory in doses up to 50 p.p.m. with a 24-hour contact period did not faze them.

*Concrete tunnel lining* received endorsement when the 5.5 mile Blue Island Ave. tunnel of the Chicago water system was unwatered last year, exposing a lining, placed 25 years before, of a 10-inch thickness of 1:3:6 concrete.<sup>30</sup> There was practically no sign of erosion. Water was found entering through the concrete in numerous places but not in sufficient amounts to be a hazard to health. The most prominent features were large accretions of calcium carbonate, one 5 ft. long, 3 ft. wide and 13 in. thick. These were found at 90% of the construction joints, indicating that these had not been made tight, the accretions being due to leakage, which, however, had "healed itself" in most places.

#### Bibliography of Recent Water Works Literature

c, indicates construction article; n, note or short article; t, technical article.

*Civil Engineering, April.*

1. Arizona Adopts a Code for Dams. J. A. Fraps, pp. 195-199.

2. t. Reservoir Storage above Spillway Level. H. K. Barrows, p. 233.

*Journal, New England Water Works Association, March.*

3. The New High-Service Water Supply of Concord, N. H. Percy R. Sanders and Frank A. Marston, pp. 1-12.

4. Experience with Ammonia-Chlorine Treatment of the East Providence, R. I., Water Supply. James V. Turner and Charles L. Pool, pp. 13-21.

5. Replacement of Brook Crossing with Bridge Crossing on 42-inch Pipe Line. Harold W. Griswold, pp. 22-26.

6. t. The Design of Pipe Lines. Karl R. Kennison, pp. 27-39.

7. Manganese in Impounded Water Supplies. Robert Spurr Weston and Attmore E. Griffin, pp. 40-51.

8. Reconstruction of the Lebanon, N. H., Water Works. Richard S. Holmgren, pp. 52-60.

9. t. The High-Speed Diesel Engine as a Prime Mover for Pumping Stations. Elliott Earl, pp. 61-73.

10. Relation of Geology to the Groundwater Supplies of New England. Irving B. Crosby, pp. 74-95.

*Missouri Water and Sewerage Conference, Eighth Annual Report.*

11. What Water Purification Operators Are Thinking About. Charles A. Spaulding, pp. 5-12.

12. When and How to Wash a Filter. August V. Graf, pp. 13-17.

13. Bacteriological Laboratory Control. H. O. Hartung and J. P. Smouse, pp. 18-21.

14. Chemical Laboratory Control. Roger C. Higgins, pp. 22-23.

15. Activated Carbon Treatment. Frank E. Turner and Carl Haynes, pp. 24-25.

16. Prechlorination. Cleo Brown, p. 26.

17. Zeolite Softening of a Well Water Supply. A. W. Kirby, pp. 27-32.

18. Results from a Small, Inexpensive Iron Removal Plant. E. S. Flannery, pp. 33-34.

19. Determining the Proper Water Rates for Smaller Communities. R. E. Duffy, pp. 35-39.

20. Water Service Materials. W. B. Rollins, pp. 40-42.

21. Routine Inspection of Fire Hydrants in Preparation for the Winter Season. W. H. Henby, pp. 43-47.

22. Economy Derived from Proper Selection of Pumps. H. C. Henriel, pp. 48-52.

23. Painting Standpipes and Elevated Tanks. H. E. Newell, p. 53.

24. Preparing and Collecting Water Bills. W. E. Barnes, p. 54.

*Water Works Engineering, April 5.*

25. Municipal Water Softening. E. L. Lium, pp. 277-280.

*April 19*

26. Laying Pipe over Rough Territory at Herkimer, N. Y. C. Leland Wood, pp. 319-322.

27. Manganese in Water Supplies. Carl Zapffe, pp. 323-325.

28. n. Reservoir in Restricted Section Provided with Parked Covering. Arthur Taylor, p. 326.

29. Some Electrical Kinks in Water Works Practice. J. H. Read, p. 327.

*Engineering News-Record, March 23.*

30. Concrete Water Tunnel Inspected after 25 Years, pp. 374-376.

*March 30*

31. New Water Plant Stresses Pre-Treatment. G. Gale Dixon, pp. 395-399.

32. Architecture Applied to Elevated Steel Tanks, pp. 403-405.

(Continued on page 38)



# THE EDITOR'S PAGE

## **The Projected Public Works Program— Get Ready**

Plans for a Federal public works program to effect the expenditure of about a billion and a half dollars within the next year are progressing. They will probably come to a head within the next two months. Now is the time to get ready.

How shall this money be spent? It can be spent on slum clearance, parks, soil erosion prevention and reforestation. Or it can be spent on true public works projects for the betterment of public health and commerce.

According to its health commissioner, New York State has saved \$20,000,000 in the past five years by typhoid fever prevention work. This saving was not accomplished by park improvement, soil erosion prevention or reforestation. It was accomplished by improving water supplies, by building sewage treatment plants, by reducing fly carriage of disease through proper disposal of refuse and by other public health measures. And in that regard, the saving accomplished through typhoid reduction is but an index of what has been accomplished in reduction of other diseases. The total saving is probably many times that given above.

A sound extension of our highways system, better water supplies, sewage treatment facilities to protect health and prevent the increasing pollution of our streams, and adequate garbage and refuse disposal are the soundest, most needed and most useful for the public good. Also, in the broadest and best sense of the word, they are self-liquidating.

Moreover, by spending the funds made available on municipal rather than on federal or even state public works, the money is spread more generally throughout the country, and workers thereon need not leave their homes and families to concentrate in large units on a few widely scattered federal or state projects.

## **A Revealing Experience in Public Works vs. the Dole**

Faced by the prospect of 8 hours of work a day, many of the unemployed did not take kindly to service in the Civilian Conservation Corps. It is noteworthy that the government chose to go to those now on the relief rolls for pioneer membership in this organization. Whether or not this course was selected purposely to demonstrate the point, the result in the East, at least, shows very clearly and pretty much beyond question that the dole, in whatever form, is the worst, and in the end, the most costly form of relief.

A whole new generation is being taught how to live without work, and to subsist in idleness. To those who have had experience in relief work, the viciousness of such a system is no surprise. There are, of course, many most worthy folks receiving relief; there are very many, and the number is growing, who prefer such relief to honest work.

This last experience should convince most of those who have had no previous experience in this line, that an adequate program for the relief of unemployment

through needed and useful public works, though it does cost money, will be a million times preferable to creating still more parasites, and then confirming them in their parasitism.

"Millions for needed and useful public works, but not one cent for confirming idleness and creating new idlers" might well be our cry today.

## **"Swat the Fly" Now—for 1934**

With the approach of spring weather our health officials are repeating the old rallying call of "Swat the Fly."

The time to have swatted this year's fly was last year when some of the money spent for relief funds could have been put into a modern incinerator and into sewers and a treatment plant.

It is outright foolishness to shut our eyes to the necessity for eliminating the garbage dumps that infest too many of our cities. These, with the outdoor toilets, which ought to be replaced with sewerage, can produce flies far more rapidly than our total population can swat them.

If we want to swat the fly crop of 1934, now is the time to start. Incinerators for refuse and sewers for other wastes is the only way to do it. Unless, perhaps, we may pay the unemployed for doing it, one by one—one swat—one fly.

## **The Railroads and the Highways**

With the falling of the revenues of the railroads and with their consequent financial insecurity, there is a renewed cry for the elimination of competitive highway transportation.

The real difficulty lies mainly in the fact that the railroads will not give the service that highway transportation gives, dollar for dollar. This goes pretty much whether we refer to passenger or to freight traffic.

There is scarcely a man in a position of power in the railroad field who has not been an integral part of the railway operating organization for forty years. We must recognize that such conditions tend very much to inhibit any new ideas on the part of the railroads.

Maybe a little new blood or new ideas or both is the answer to the railway problem, and not the throttling of a newer and more progressive form of transportation.

We need the railroads, but it is necessary that their progress keep in step with the times.

## **Notice to Officers of the Sanitary Corps**

Men who hold commissions as junior officers in the Sanitary Corps of the U. S. Army, who have had experience in sanitation and public health, especially under rural conditions, and who are now unemployed, are requested to write to Major W. A. Hardenbergh of this magazine.

It is possible that there will be a limited number of opportunities for men with such qualifications, though nothing is now assured. These positions may open at any time and in any location. It is desired that a list of those who can qualify as above be available.

# Incinerator Firing at Washington, D. C.

TWO rubbish incinerators were built for Washington, D. C., last year, known as the Georgetown and O Street plants, and operated during a test period extending from September 26th to November 30th. As both were of similar design, prepared by the same engineers, differences in operating details were dependent largely upon differences in material received at the two plants, relative experiences of the workmen, and the fact that one was operated at full and uniform capacity and the other at a varying rate averaging about half the full capacity.

**Material Burned.** The Georgetown plant, containing two furnaces, received principally domestic rubbish collected by municipal employees. The O Street plant, containing five furnaces but otherwise similar to the Georgetown, received domestic rubbish municipally collected; rubbish from hotels, apartments, business houses and institutions delivered at the plant by private collectors; and large volumes of fallen leaves. Tin cans are included with the rubbish; also large incombustible objects such as bed springs, oil stoves, etc., which are not placed in the furnace. Considerable worn-out paper money, ground to a wet pulp by the Treasury Department, is burned daily; also tons of blotting paper from the postage stamp printing presses are delivered daily in tightly wound rolls.

**The Furnaces.** Each plant consists of a building having a receiving bin extending through the entire center, with the furnaces on one side of it, and on the other side a dumping space. A grab bucket operated by electric overhead travelling crane removes the rubbish from the bin to hoppers over the furnaces. Trucks entering onto the dumping space pass over a scale platform. Under the furnaces is an ash tunnel. The Georgetown plant has one chimney, the O Street plant two. Forced draft is provided but is used only when burning very compact or heavy material. Stoking is done through small doors; guillotine doors are used for week-end inspections. (Local laws forbid operation or rubbish collection more than five days a week.) There are no drying hearths in the furnaces. There are no air heaters, but auxiliary fuel oil burners may be used when the rubbish is excessively wet or when starting up a cold furnace.

**Operation.** The furnaces are run continuously in three eight-hour shifts from Monday morning to Friday night, at as nearly a uniform rate as possible. All deliveries are made during the day shift, when one man is employed sweeping the dumping floor at Georgetown, and two at O Street where they also assist in dumping private vehicles. At Georgetown there is one crane operator for each shift; at O Street a second operator for a second crane is required when more than three furnaces are in use. One man at Georgetown and two at O Street are employed on the charging floor, regulating the flow of material through the hoppers. Two stokers per furnace per shift were used at first, but one sufficed when they had gained experience. One ash tunnel man is used at Georgetown, where the ashes are dropped from the ash pits directly into motor trucks, and two at O Street, where the ashes are removed in trolley cars. There is a foreman at each



Receiving pit. Grab bucket above.  
Dumping floor at left. Washington, D. C.

plant for each shift, who attend to the draft and temperature control and generally supervise operation. The ash tunnel men control the quenching of the ashes with water and the ash pit gates and occasional bridging of ashes in the ash pits.

At Georgetown the draft is about 1.6 inches of water at the base of the stack and 0.3 inch in the ash pit. At O Street it is about 1.0 inch at the base of the stack and 0.3 inch in the ash pits. The furnaces have no drying hearths. The fuel bed averages 12 inches thick at front and 24 inches at the rear. When operated at the rated capacity of 85 tons per furnace, charges are admitted to the furnace at the rate of about one a minute.

Three excess air inlets in each furnace are controlled automatically from pyrometers, keeping the temperature generally between 1400° and 1650°, occasionally reaching 50° to 100° either way beyond these limits for five minutes or less.

**Operating Data.** Operating data are entered on forms, each summarizing the data for one five-day week. The figures for one week for each of the plants are as follows:

Rubbish	Georgetown	O Street	Unit Costs	Georgetown	O Street
Tons .....	707	1095	Labor/ton .....	\$ .88	\$ 1.29
Yards .....	5863	7730	Water/ton .....	.15	.08
Lbs./yd .....	241	283	Electr./ton .....	.10	.10
Ashes			Total/ton .....	1.13	1.47
Tons .....	456	397	Furnace		
Yards .....	617	538	Hours No. 1 ..	120	97.4
Lbs./yd. ....	1478	1477	No. 2 ..	120	109.0
Water cu. ft. 152420	123040		No. 3 ..		24.0
Power kwh. ....	2387	4500	No. 4 ..		104.6
Light kwh. ....	608	1129	No. 5 ..		40.0
			All .....	240	375.0

At Georgetown the percentage of ashes to rubbish was 64.5 by weight and 10.5 by volume; while at O Street the percentages were 36.8 and 7.5 respectively. The abundance of tin cans made these figures higher than in some other cities. The quenching water added to the weight of the ashes, which was reduced to about 1100 pounds when the men had gained experience in quenching and draining. The higher weight per yard of rubbish at O Street is due to the larger proportion of leaves.

As the operators gain in experience it is expected that the efficiency of operation will be improved.

The above information is from a paper by Harrison P. Eddy, Jr., read before the American Society of Municipal Engineers.

---

# MAINTENANCE

## *Conserving Our Highway Investment*

---

### Ten Highway Commandments for Planning Your Highway Program

By W. A. HARDENBERGH

*For the guidance and consideration of highway engineers in these troublous times, we offer the following "Ten Highway Commandments" outlined by J. E. Pennybacker of the Asphalt Institute.*

1. Study diligently your local needs and conditions and seek all possible information on latest methods of maintenance and construction.
2. Study latest equipment available to secure better roads at lower cost.
3. Maintain your highways to avoid any capital loss.
4. Stop excessive maintenance costs by reconstruction with a type best suited to the traffic.
5. Obtain maximum traffic value by closing up gaps with new construction, and do not fear to invest in new construction where it is needed and the cost is justified.
6. Use local materials to the maximum degree possible, but do not spoil an otherwise good road by the use of poor material.
7. Remember the unemployed and adapt your programs to aid them to the maximum degree consistent with good work and proper expenditure of funds.
8. Have regard for the safety of pedestrians and motorists, and eliminate, where possible, dangerous curves, hidden grade crossings and other danger factors.
9. Remember the farmer whose sole transport dependence is the highway, and so distribute your highway work as to take him out of the mud.
10. Remember that the motor taxes and the gasoline taxes are paid by the highway users and that these funds should, in all justice, be used only for highways.

---

So swiftly does the science of highway construction and maintenance progress, that continuous study of newest developments is necessary. This is no less true of manufacturers of highway equipment than of engineers who use that equipment and of the bituminous material industry. In the following pages are some excellent articles, yet they touch no more than the high spots, and in the limited space we have available we can little more than point out the road of progress. Study the above list of "commandments" with your own local conditions in mind, and plan your program to meet the needs of your community. If you have done a good job, write us about it; if you want help or advice, write us for it. It is our pleasure, our duty and our invaring policy to serve you. This special section will be continued next month, with another program of sound and worth-while articles.



# Smother Riding Roads and Longer Life

## *Obtained by New York's New Drag Treatment of Bituminous Surfaces*

By A. E. Stewart

Senior Civil Engineer, New York State Dept. of Public Works

IF THE effect of impact in destroying road surfaces is to be eliminated, or even reduced, it is necessary to maintain our roads in such a manner that the irregularities in the road surface are reduced to a minimum. With this in mind, New York is getting away from the old-fashioned surface treatment, feeling that one of the main objectives of any surface treatment is the elimination of any irregularities in the surface to be treated. This certainly is an important factor in the economical maintenance of semi-rigid base roads, of which New York has many miles. The smoothing up of any rough surfaces not only reduces the destructive action of impact, but also forms a smooth-riding surface, safer and better for high-speed traffic of today.

In order to overcome these destructive factors, we have used a new type of surface treatment, known today as the drag treatment, which averages  $\frac{1}{2}$ " to 1" in depth. Although drag treatments vary somewhat as to the number of applications of bituminous material and the amount of cover, the following method was used in this District with gratifying results.

The loose material was cleaned from the surface of the old stone or macadam road, after which bituminous material meeting New York bituminous specification "T" was applied at the rate of one-tenth to fifteen-hundredths gallon per square yard. This first application acted as a prime coat—the amount of tar used depending on the condition of the old road as to its absorptive ability, etc. For public convenience, only half the width of the road was treated at a time. Crushed stone,  $\frac{3}{8}$ " in size, was immediately spread over the tarred surface at the rate of approximately 45 pounds per square yard.

A box type spreader was used to spread a definite amount of stone uniformly over the road surface. This is very important, as the success of the treatment depends on getting the right proportion of bitumen and aggregate. After the aggregate had been spread for a distance of at least 1,000 feet, a second application of tar was applied on the loose stone at the rate of three-tenths to thirty-five hundredths gallon per square yard, and immediately mixed with the aggregate.

The mixing operation was accomplished by means of drags of the herring-bone type. Ordinarily, one drag of the leveling type was sufficient to get the desired results. However, it was found that if the road surface was very rough and full of sharp dips it was advisable to use a short mixing drag in order to reach the bottom of the depressions so as to insure a thorough mix. When this condition existed, a light truck or tractor was used to haul the mixing drag through the aggregate several times. After this, the leveling drag was then attached behind a light roller weighing from five to seven tons, which not only rolled the mixture of tar and aggregate, but also mixed and leveled the coated aggregate in one operation. The roller compacted the mix while the leveling drag scraped the aggregate from the high spots, mixed it and deposited it in the depressions. This process was repeated several times until all the depressions were sufficiently filled and compacted, after which the surface was given a thorough rolling.

Where the proper amount of aggregate and bitumen had been used, the resultant surface was extremely smooth, well compacted and of granular or open void

appearance. Also, if the proper quantities of tar and aggregate are used, no trouble will be caused by bleeding during the hot weather. Ordinarily about one-tenth gallon to 10 lbs. of aggregate is used. However, if the old road presents a porous surface, a slightly greater amount of tar may be necessary.

For real smoothing up purposes, it is well to keep in mind that it is necessary to use approximately 30 lbs. or more of aggregate, depending upon the roughness of the surface treated.

To avoid bleeding in this type of surface, the prime application of tar should be as thin as possible, using only a sufficient amount to obtain a continuous film over the old road surface. Ordinarily for this purpose one-tenth gallon per square yard will be sufficient.

The drag, which has a two-fold function of mixing and leveling the tar coated aggregate, is ordinarily 16 feet long but may be varied to meet conditions of grade. Where the grades are short, with sharp vertical curves, a shorter length drag will be found more effective. Where as much as 45 to 50 pounds of aggregate has been used, a motor grader may be used as a substitute for the drag, although it is a little more difficult to handle for this type of work.

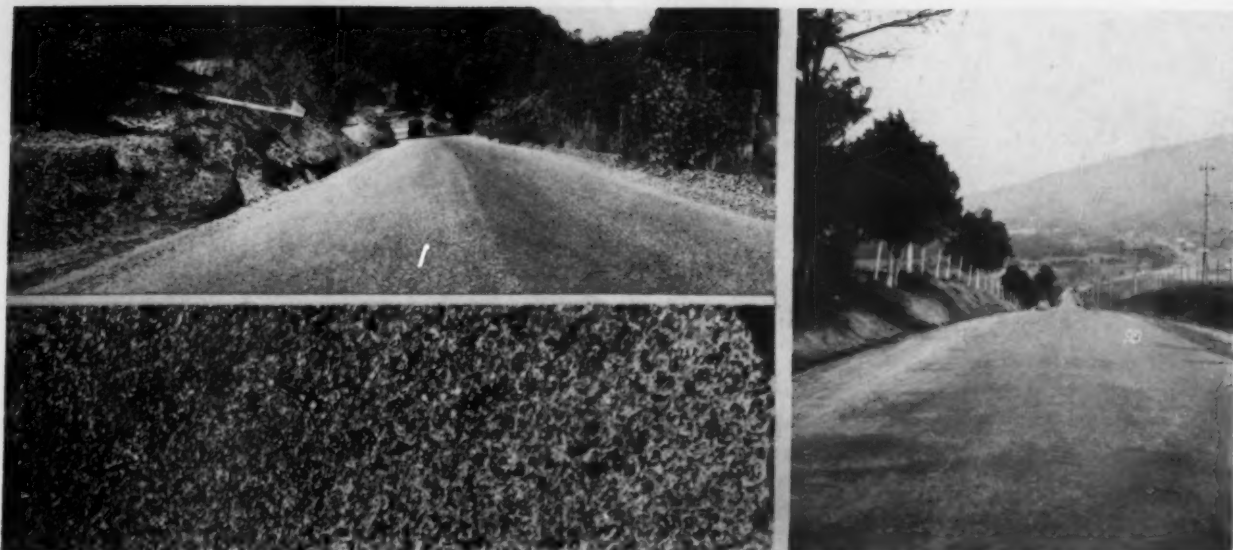
From the above description it is seen that the operation described is somewhat similar to that employed for the construction of the so-called mixed-in-place or road mix surface. Although other bituminous materials than tar can probably be used with success for this class of work, tar was chosen by the writer as it gave sufficient time for manipulation before setting up, to obtain an extremely smooth-riding surface. In fact, the characteristics of tar seem to fit in with this type of treatment so well that no other material was tried.

It must be understood that the quantities of material given are average and can be varied to meet the different conditions. For instance, on a rough, irregular road surface, the quantity of tar and aggregate should be increased and  $\frac{3}{4}$ " aggregate used instead of  $\frac{5}{8}$ -inch.

As the quantities of tar and aggregate, as well as the amount of labor, are practically double that required for the old standard light-surface treatment, it is easily seen that where the old method of surface treatment cost from \$0.04 to \$0.05 per square yard, the drag surface treatment will cost from \$0.08 to \$0.10 per square yard.

As to the relative value between the two treatments, the comparison is all in favor of the drag surface treatment. It accomplishes everything done by the old method of surface treatment, and in addition has eliminated the irregularities in the old surface, reduced the detrimental effects of impact, and its accompanying maintenance costs. Due to the increased smooth-riding quality of the road surface, the public has been so impressed with the marked improvement of the roads so treated that we have received many complimentary comments on the results obtained. This, together with the sound engineering advantages of the drag surface treatment, points to increased use of this type of treatment.

This work was done under the supervision of the Utica Division of the New York State Department of Public Works. The tar was furnished and applied by the Koppers Products Company, Pittsburgh, Pa.



The road above, at left, cost \$2,653 per mile; close-up of surface below; a Virginia surface treated road at the right

## Bituminous Surface Treatments for Roads and Streets

By Bernard E. Gray

By surface treatment is meant the placing of a thin carpet coat, using one of a variety of bituminous materials, followed by covering with mineral aggregate; the completed depth of such improvement being not over one inch. Surface treatment has been used in a wide range of conditions, not only as an original construction method but also as a means of maintaining and preserving various types of existing improved surfaces. (A complete discussion of this subject has been prepared by The Asphalt Institute and issued as "Construction Manual No. 2—Surface Treatment Types.")

The purpose of this article is to point out the value of such methods in improving roads and streets where the surface now in place has proven inadequate for traffic.

**T**HERE is a definite relationship between the amount of bitumen and the amount of aggregate required for any given set of conditions, and it applies with equal force to high-type pavements such as sheet asphalt or asphaltic concrete and to low-cost types, such as surface treatment. There is often a tendency to use too much bituminous material, sometimes because of inadequate equipment which cannot spray a lighter application, but usually because of other reasons. Careful preliminary preparation of the surface and uniform coverage with light applications will produce better results than attempting to cover uneven surfaces with a heavy treatment. It must be remembered that it is always easy to add more bitumen when required, but difficult to remove a surplus, to say nothing of the unnecessary expense for material.

Whether or not the untreated surface contain any natural bonding material, the first step prior to application of the bitumen is to bring about a uniform condition of surface. This is particularly true with aggregates of wide grading because, if in one place there is a pocket of the coarse material and adjacent thereto a pocket of fine material, the two areas of the surface will behave differently under impact and eventually lead to

a pot-hole. This condition may be almost completely prevented by careful blading and dragging of the surface to produce a uniform consolidated condition.

### Priming

Probably one of the most important developments of recent years has been that of completely satisfactory bituminous primers. In some of the earlier surface treatment work, rather heavy bituminous products were used for surfacing which, because of their character, cooled quickly upon application. While a tough, resilient mat was formed, it was not thoroughly bonded to the underlying aggregate and eventually tended to move under traffic, and entrance of water under the mat caused a lessening of stability which led eventually to pot-boiling. The use of the modern primer almost completely prevents these adverse developments. Therefore, the first application of bituminous material should consist of a sufficient amount of primer, so that penetration to a depth of from  $\frac{1}{2}$ " to  $\frac{3}{4}$ " is obtained. With loose, uncemented surfaces, this will require from  $\frac{1}{2}$  to  $\frac{3}{4}$  gallon per square yard, in one or two applications according to local conditions. This primer should penetrate completely without the application of any cover coat, and thereafter traffic should be permitted to use the road for several days so as to develop any areas which have not been thoroughly hardened and cemented together. With the bonded type of surface, the amount of primer required may be as little as .2 of a gallon per square yard.

In any event, as much primer should be applied as may be totally absorbed by the surface. The ranges above given of .2 gallon to about .8 gallon per square yard will take care of extreme conditions. The value of MC-1 priming material is in the peculiar property



which it possesses, viz; high penetration at a very rapid rate, after which the distillate separates from the asphalt base by selective absorption, leaving the asphalt cement distributed through the upper layer of the road surface in such a form that it develops a high degree of cementing quality, firmly coating all of the fine particles and sticking them thoroughly together. A few days' traffic then searches out any weak spots so that additional primer may be applied, plus sufficient aggregate of the same character as the roadbed to produce a firmly bonded surface of uniform contour.

#### Seal Coat

The road is now ready for the seal coat application, which is to waterproof the surface and hold the aggregate cover which takes the abrasion of traffic. A variety of materials may be used for this purpose. In general, the cutback asphalts and emulsified asphalts have been used in northern latitudes, and the soft asphalt cements in the more southern areas. The real criterion, however, is the degree of stability of the road surface, and there is a trend toward the greater use of the soft asphalt cements as a seal coat in many areas. The seal coat application with cutback asphalt is usually at the rate of from .25 to .3 gallon per square yard. With sandy gravels, the cover coat may be of a sandy gravel, while with other varieties of surface a crushed aggregate of stone, gravel or slag is to be preferred. The size of the cover should be approximately  $\frac{3}{4}$ ", and the closer all the particles are to this one size, the more satisfactory will be the finished work. In other words, the same old principle of uniformity applies.

The cover coat should be spread preferably by mechanical means, followed by dragging with a broom drag so that a completely uniform depth of cover is obtained. Furthermore, this broom dragging tends to even out any inequalities in the surface and to produce the smooth riding character desired.

With emulsified asphalt, the rate of application is approximately the same as for cut-back asphalt except that in some cases a double surface application is made, using two different sizes of cover aggregate, especially for city street work where a finer texture of finished surface is desired. However, for general purposes the  $\frac{3}{4}$ " aggregate is to be preferred, not only because of the non-skid qualities but also because of the texture of the finished surface from an appearance standpoint.

Where the seal coat consists of hot asphalt cement, a material of approximately 250 penetration is employed, at the rate of around .4 gallon per square yard, followed by the application of forty pounds of mineral aggregate of approximately  $\frac{3}{4}$ " size. A good rule of thumb for any seal coat work is ten pounds of aggregate cover for each  $\frac{1}{10}$  gallon of bituminous material used, and this rate applies generally for all kinds of bituminous materials.

#### Costs

The cost of such treatment varies from one locality to another, but the general range for a total of  $\frac{3}{4}$  gallon per square yard treatment with thirty pounds of mineral aggregate is at from \$600 to \$1,200 per mile of eighteen foot width, or at the rate of \$.06 to \$.12 per square yard. Properly prepared surfaces treated by one of the above methods will satisfactorily carry traffic of as much as 1,500 vehicles per day, especially in city street construction where the movement of traffic is at rather lower speeds than are found on the rural highway. For

the rural highway, these types of treatment are rendering excellent service under traffic of 500 to 1,500 vehicles per day, and there are many instances where the traffic runs up to many thousands of cars per day.

#### Maintenance

Surfaces prepared carefully as described will require little maintenance. The use of the primer producing the hardened surface prior to the application of the seal coat has practically eliminated the necessity for retreatments the second year. The third year a light retreatment may be required at the rate of 0.1 to 0.2 gallon per square yard, the cost of which would be approximately \$300 per mile. The other maintenance costs will be occasional patching the second year, but this, once adequately accomplished, should not recur later except in isolated instances.

A superficial survey of maintenance costs of surface treatments throughout the country may indicate a high rate in some instances, but a further analysis of these costs shows conclusively that a large percentage is for capital improvement, such as widening of the surface and of the shoulders, which is more often found in connection with surface treatment because of their use as a stage construction type where old roads of relatively narrow width are being stepped up to meet heavier traffic conditions. The actual maintenance costs of properly prepared surfaces followed by correct surface treatment should not exceed \$250 per mile per year, including retreatments. In Florida, where conditions are, of course, more favorable than other parts of the country, the annual maintenances of the surfaces alone is less than \$25 per mile per year; while in South Carolina, according to the official Government records, the maintenance cost is \$15 to \$60 the first year, and \$5 to \$20 the second year. A very interesting analysis of the cost of surface treatments, made recently by Mr. Emmons of the University of Michigan, shows that for  $\frac{3}{4}$  inch depth, construction cost \$1,275 per mile, the ordinary yearly maintenance cost is \$29, and retreatment at intervals of two years or longer costs \$206.

In conclusion, the following points are suggested to engineers as worthy of their careful attention:

1. The recent developments in bituminous products (which in many cases are not yet appreciated), particularly the development of completely satisfactory priming materials which make for a durability in surface treatment work not formerly possible.
2. Products which develop high cementing qualities, of exceptional stability, unaffected by changes in temperature, may be selected in exact accordance with the character of the aggregate or surface to be treated.
3. The possibility of salvage of existing road surfaces through the use of such materials to obtain a highly satisfactory wearing course at extremely low cost.
4. Because of the highly stable surface obtained through these methods, maintenance costs are now much below those formerly required. The city engineer can use this construction to perform a substantial part of needed street maintenance at costs within his present budget, producing surfaces which will meet traffic requirements for many years. For rural roads, it is estimated that, for over one-half of the million miles eventually capable of improvement, surface treatment is the most economical method of producing surfaces which will be mudless and dustless the year around.



# Surface Treatment on Gravel Saves Money

By Robert S. Gain

Secretary, Leelanau County Road Commission

LEELANAU County, in the north-west portion of the Lower Peninsula of Michigan, is on the shore of Lake Michigan and extends out into the lake so that it is practically surrounded by water.

The county road system has been well developed during the past several years. The presence of good road-building gravel in the county was a deciding factor in the choice of gravel surfacing for the county roads.

Until recently all of the gravel roads were maintained by dragging, with the addition of new gravel as needed. Keeping the gravel roads in good condition at all times required constant attention and was a rather expensive operation, as in addition to the dragging operations it was necessary to replace with fresh material the gravel removed from the road by traffic. Actual costs for this work in 1932 are given below:

Gravel Resurfacing—1932					
Road	Miles	Width Feet	Sq. Yds. Surface	Cu. Yds. of Gravel Used	Cost
612-1	2.0	18	21,120	603	\$ 318.80
614-1	3.8	18	40,128	1590	1,062.71
616-2	7.6	18	80,256	2558	2,579.26
633-1	1.0	18	10,560	123	157.50
641-1	2.0	18	21,120	602	617.45
645-1	1.0	18	10,560	485	477.37
651-1	3.5	18	36,960	1815	1,454.22
669-2	5.15	14	42,297	1365	400.00
LEE-12	3.7	18	39,072	1277	915.92
CE-17	5.5	16	51,628	4257	2,470.23
CL-CE-18	1.3	16	12,203	746	412.59
GA-22	1.0	16	9,387	318	418.69
KA-27	4.5	16	42,241	1557	957.99
KA-28	3.65	9	19,272	1214	824.57
Total	45.70		436,804	18,510	\$13,067.30

Average unit costs are as follows:

Average cost per cubic yard of gravel .....\$706  
 Average cost per square yard of gravel .....\$.03  
 Average gravel thickness per square yard .... 1.57"  
 Average cost of gravel per inch per square yard \$.0196

Not every gravel road is resurfaced every year, so the above figures are somewhat high for the annual cost of resurfacing, but it is not unreasonable to assume the replacement of one inch per year over the entire mileage, which gives an annual cost of \$.0245 per square yard per year. This figure is closely checked by spreading the resurfacing cost over the entire untreated gravel road system of 524,024 square yards, which give an average annual cost of \$.0249 per square yard.

In addition to the resurfacing cost, a certain amount of patching was necessary, and the average cost of this per square yard for the entire untreated gravel road system in 1932 was \$.014.

Average dragging costs over the 524,024 square yards of the system in 1932 were \$.009 per square yard per year.

The average cost for chemical dust layer for the entire system was \$.0135 per square yard per year.

The annual cost per square yard for the maintenance



Surface mat on gravel

of the untreated gravel roads would be as follows:

Dragging .....	\$.009
Patching .....	.014
Resurfacing .....	.0245
Dust layer .....	.0135
Total .....	\$.0610

These costs are not high as gravel road maintenance costs go, being something over \$600. per mile per year for an 18-foot road.

In an endeavor to produce a more satisfactory surface and to reduce maintenance costs, if possible, the construction of Re-Tread tops over the existing gravel roads was begun in 1931. This work was continued in 1932 with a total of 28.8 miles (about 290,000 sq. yds.) of this type built to date on the county road system.

In building the Re-Tread top it was decided to add sufficient new aggregate to that already on the road so that the finished depth of the top would be from 1 to 1½ inches. This additional aggregate was obtained from local gravel pits. The oversize was crushed so that the final aggregate on the road contained about 60 per cent of crushed material.

The loose material was spread over the surface and given an application of from ½ to ¾ gallon of heavy Tarvia Re-Tread per square yard, and the tar and gravel mixed immediately with an Adams Re-Tread mixer. A slight excess of tar was used so that part of it would serve as a prime coat on the untreated gravel.

The mixture was then spread out and rolled in place as soon as it became tacky. Surface voids were then filled with cover-size gravel and a seal coat of about 1/3 gallon of heavy Tarvia Re-Tread. This was covered with small gravel and the road opened to traffic.

This construction cost \$.195 per square yard for the 1¼-inch depth and \$.156 per square yard for the 1-inch depth.

Based on our experience in maintaining tar surface treatments on the State trunk highways within the country since 1925, we estimate that these Re-Tread surfaces will require a surface treatment every three years and that the annual cost for patching and such surface treatment will be \$.01 per square yard per year.

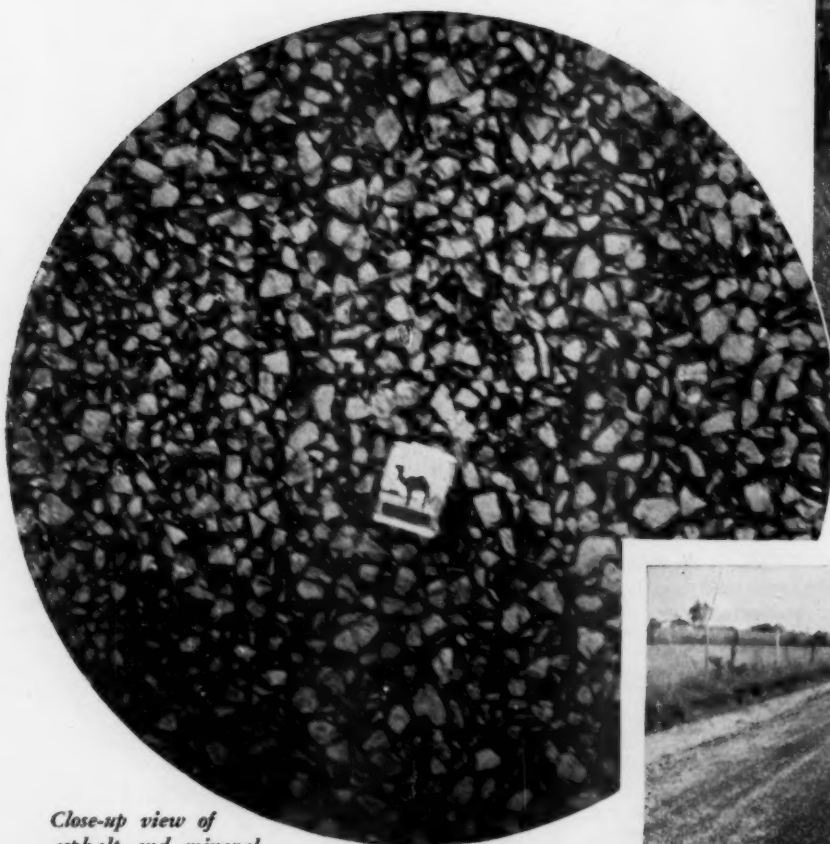
The tabulation below indicates that the Re-Tread top would be paid for out of maintenance savings at the end of five years.

Year	Gravel Maintenance Costs Per Square Yard Re-Tread		Untreated	
	Annual	Cumulative	Annual	Cumulative
1	\$.212	\$.212	\$.061	\$.061
2	.017	.229	.061	.122
3	.017	.246	.061	.183
4	.017	.263	.061	.244
5	.017	.280	.061	.305

This work was done by the Leelanau County Road Commission under the direction of the writer and Miller Bidleman, superintendent of the field operations.



*Applying cut-back asphalt previous to mixing and surfacing, and in some cases rolling.*



*Close-up view of asphalt and mineral aggregate after mixing and surfacing.*



*After application of cut-back asphalt, it is thoroughly mixed with the mineral aggregate.*



*Completed roadway. As traffic runs over the road the surface becomes more compact and smooth.*

THERE IS NO BETTER INVESTMENT FOR TAX FUNDS THAN BUILDING LOW COST ROADS

# 4 POINT ROAD PLAN PLEASES TAX PAYERS

● *Chicago, Illinois* — Smart highway officials through the Middle West agree that the Four Point Road Plan is the solution of this year's problem. Tax payers demand lower road costs, but will insist on adequate mileage as compared to previous years. The Four Point Plan is briefly:

1. Concentrate construction on local roads.
2. Use products of unquestioned quality.
3. Refuse all projects going beyond reduced budgets.
4. Keep mileage of roads up to previous years.

● For economical maintenance of roads use Asphalt. Inexpensive resurfacing with Stanolind Cut-Back Asphalt provides fine riding surfaces on old road foundations without waste of previous investment or expensive new sub grade.



*In the Middle West there are more miles of Stanolind Cut-Back Asphalt than any other kind. Low cost roads built with Stanolind Cut-Back Asphalt are both durable and economical.*

The logical local road material is Asphalt, and the logical Asphalts on the principle of buying only unquestioned quality are Standard Oil Company (Indiana) Asphalts.

May we ask one of our highway specialists to

talk with you about how Standard Cut-Back Asphalt can help you to make a real record?

• • •

STANDARD OIL COMPANY

(Indiana)

104

910 South Michigan Avenue

Chicago, Illinois

*When you write—please mention PUBLIC WORKS*



# FOR BITUMINOUS ROADS

## Blaw-Knox (Madsen) Asphalt Plants

*Precise Engineering Control of Bituminous Pavement Construction is Provided at Low Initial Equipment Cost . . .*

Plant-Mix Bituminous types of roads are low in first cost. Blaw-Knox (Madsen) Asphalt Plants allow complete control of the mix and permit the use of the most desirable bitumen.

In many cases, the first cost for plant is less than for equipment for mixed-in-place work.

*Less time lost* due to unfavorable weather conditions because Blaw-Knox (Madsen) Plants work 25% to 30% more days, and their *designed mobility* makes them easily portable at low cost.

Better control of the mix is possible; and proper grading of aggregates is just as important in bituminous paving as in concrete construction.

Most suitable bitumen can be used. Should a high viscosity bitumen be best suited for the work, it can be used.

Blaw-Knox (Madsen) Portable Mixing Plants meet exacting specifications for economical and consistent production of low cost bituminous highways. They allow precise control of moisture content, aggregate grading, bitumen content and mixing time. A catalog will be sent upon request.

### SPECIAL ADVANTAGES

\* \* \*

FIRST COST IS LOW

\* \* \*

LARGELY  
INDEPENDENT OF  
THE WEATHER

\* \* \*

BETTER CONTROL  
OF THE MIX

\* \* \*

EASILY PORTABLE

\* \* \*

HIGH VISCOSITY  
BITUMEN  
CAN BE USED

## BLAW-KNOX COMPANY

2019 Farmers Bank Building

Pittsburgh, Pa.

*Offices in Principal Cities*

# BLAW-KNOX

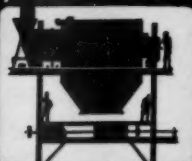
Illustrating the quick portability of the Blaw-Knox (Madsen) Asphalt Plant



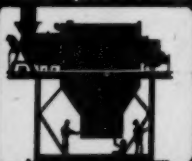
Monday - 2 P. M.



Monday - 4 P. M.



Monday - 6 P. M.



Tuesday - 9 A. M.



Tuesday - 10:30 A. M.

For latest catalogs, consult the *classified INDUSTRIAL LITERATURE* section—page 43.

# FROM THE THINNEST FEATHEREDGE TO THE DEEPEST POT-HOLE

*... STANDARD Asphalt will do the job  
more economically, more lastingly*

**F**OR the thinnest featheredge and the deepest pot-hole. For the filling of cracks, for entire resurfacing. For the prevention of raveling of a gravel road... in fact, for every road construction need, Asphalt fits in with the present-day demand for durability combined with economy.

There is no finer line of asphalt products available than STANDARD (Socony brand). This line includes:

Standard Asphalt Binder A for surface treatment.  
Standard Asphalt Binders B and C for penetration work (Asphalt Macadam).

Standard Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete).

Standard Cold Patch Asphalt for all types of patching.

Standard Paving Asphalt for sheet asphalt paving.

Standard Asphalt Paving Fillers.

Standard Waterproofing Asphalt.

*Specifications and all other particulars furnished on request.*

STANDARD OIL COMPANY OF NEW YORK, INC., 26 BROADWAY, NEW YORK, N. Y.  
A SOCONY-VACUUM COMPANY

# STANDARD

SOCONY BRAND

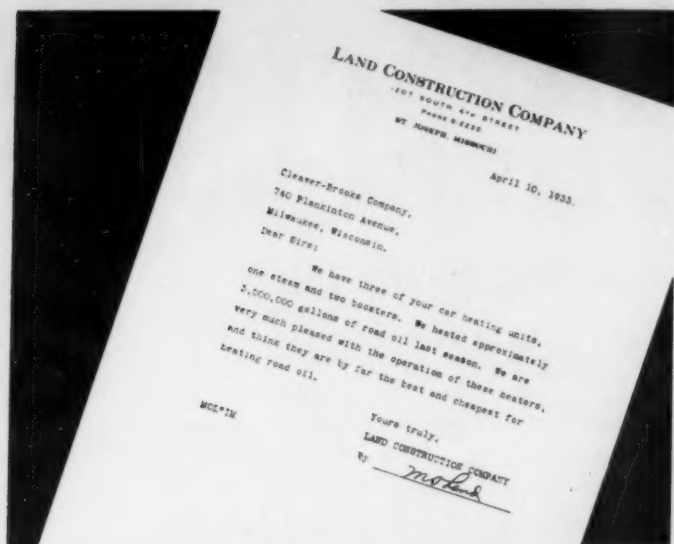
## ASPHALT PRODUCTS



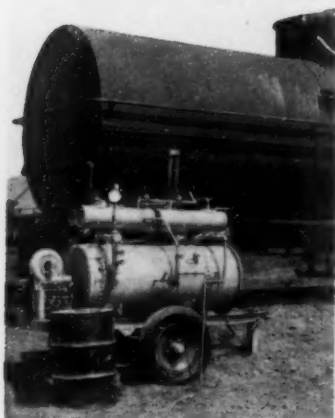
*Elevated Highway from 59th to 72nd Street, New York City. Granite block pavement, joints paved with Socony Asphalt Paving Filler.*



For reviews of Booklets giving details on maintenance refer to pages 43 and 44.



## "BEST AND CHEAPEST FOR HEATING ROAD OIL"



**3 Cleaver Heaters  
Heated 3,000,000  
Gallons of Oil Last  
Season!**

The above performance record is impressive . . . It bears witness to the efficiency and economy of Cleaver Tank Car Heaters . . . It proves conclusively that Cleaver Units will heat bituminous material rapidly.

### Only Proven Method

The Cleaver Heater is the first unit to become commercially successful . . . It has solved the problem of heating bituminous materials to both pumpable and application temperatures. Send for bulletins which will give you full details!



**CLEAVER-BROOKS CO.**

742 N. Plankinton Ave.

Milwaukee, Wisconsin

# CLEAVER

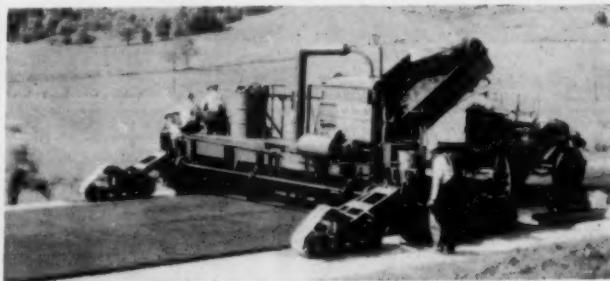
## TANK CAR HEATERS

## the 1933 Barber-Greene Bituminous Paver



and

## the 1933 Barber-Greene Spreader-Tamper-Finisher



## Build LOW COST—HIGH QUALITY Bituminous Roads

If you are interested in building bituminous roads with accuracy, speed, uniformity, and low cost investigate these Barber-Greene.

The new tamping action on the Finisher never lets the tamper drag on the surface. It feeds exactly the needed amount of material, it gives uniform compaction, it seals the road against rain.

The B-G Finisher is an independent unit. It can receive the material from trucks or travel plant. It does not allow segregation of the coarse and fine materials. It produces a smooth riding surface without the use of forms. It spreads, tamps, and finishes to completion in two minutes, thus handling quicker setting materials, and working in lower outdoor temperatures.

The performance of the B-G Paver includes mixing asphalt, tar products, cut back, emulsion, heavy and light road oils, with crushed stone, gravel, chats and 200 mesh silica. It includes work in eight states in various climatic conditions, for instance one job where Tarvia A was used at an atmospheric temperature of 45°. It includes 144 miles in Kansas alone. It includes such figures as 3 miles in one day and 61 miles in 44 working days, and another job where 32 miles were done in 256 machine hours.

Let our engineers furnish details of applications and costs of operation on the work you are interested in.

Standardized Material  
Handling Machines

# BARBER GREENE

635 West Park Avenue,  
Aurora, Illinois





*Old York Rd. north of Elkins Park, Pa., one of the many highways in Pennsylvania on which Genasco Concrete Crack Filler has been used.*

## ASPHALT FILLERS

**G**ENASCO Crack Filler and Genasco Block and Joint Filler made with Trinidad Lake Asphalt with its inherent mineral filler are stable, adhesive bituminous products intended respectively for use in filling cracks . . . for filling lateral and transverse joints in old concrete roads . . . for pouring joints in new concrete roads . . . for filling joints in granite block or brick pavements.

Both types of filler have a flash point well above 350° F. . . are not of an explosive character . . . are no more difficult to handle than the usual type of road binders . . . and are extremely adhesive. While they are susceptible to temperature changes to a certain degree (therefore self-healing) they do not develop the extreme tackiness of those materials that do not contain a mineral filler.

Genasco Crack Filler and Genasco Block and Joint Filler are better suited for filling cracks in concrete pavements . . . for filling joints in granite block or brick pavements than any of the blown types of asphalt. That's due primarily to the fact that in winter, while harder than blown asphalts, they will show greater adhesion to concrete, granite block or brick.

*Get in touch with us for further information and prices.*

**THE BARBER ASPHALT COMPANY  
PHILADELPHIA**

New York

Chicago

St. Louis

**Genasco**  
REG. U. S. PAT. OFF.

## Maintain Your Bituminous Macadam Highways with LITTLEFORD EQUIPMENT

**W**HATEVER the job—whether penetration patch work, skin patching, surface treatment or resurfacing—there is Littleford equipment to do the work. You may need only a 10-gallon "tar" kettle—and then again, a 1500-gallon pressure distributor may be what you require.

You know that it costs much less to maintain a road than it does to do a complete reconstruction job. You know that it is of vital importance to keep your present highway system properly maintained . . . We have the equipment that will help your maintenance gangs do their work efficiently. Get more maintenance mileage out of your highway dollar. Write for our complete catalog now . . . See the latest maintenance outfits we are offering.



**T**HE Littleford Bituminous Spray Tank No. 101 is used for surface treatment, shoulder work, widening curves, penetration patching, etc. An ideal outfit for unemployment relief work. It handles material just like a pressure distributor—pumps material into its tank, circulates and heats material, and sprays. Costs half the price of a distributor. Made in capacities from 300 to 1200 gallons.



**W**HEN bituminous macadam highways get "fatty" and slippery, use the Littleford Surface Heater to restore the non-skid texture of the road. . . This outfit is also used to soften sheet asphalt surfaces preparatory to patching. It's the only surface heater that can be satisfactorily trailed behind a truck.



**LITTLEFORD**  
*Road Maintenance Equipment*  
**SINCE 1900**

LITTLEFORD BROS. 452 E. PEARL ST. CINCINNATI, O.



Ruggedness of design is the basic reason for the reliability of BUFFALO-SPRINGFIELD rollers.

TANDEM AND THREE-WHEEL

THE BUFFALO - SPRINGFIELD ROLLER CO.  
SPRINGFIELD, OHIO

*Buffalo Springfield*

## Cut Highway Maintenance Costs With the Improved ETNYRE Oil, Tar and Asphalt Distributor



**T**HERE is an insistent demand for economy in building and maintaining the country's highways which demands the selection of a machine of highest efficiency.

Another active season is here and it is time to check the new ETNYRE distributor and note the many new improvements in this year's models.

*Write to us for complete details*

**E. D. ETNYRE & COMPANY**

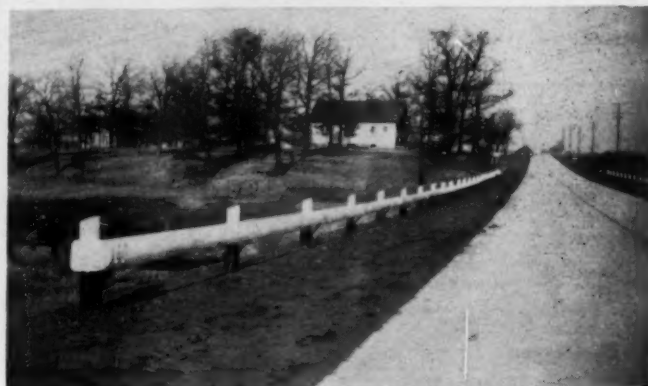
*Manufacturers of a complete line of Oil, Tar and Asphalt Distributors*

OREGON

ILLINOIS

## TUTHILL HIGHWAY GUARD

Minimum Maintenance—Maximum Efficiency



Lake County. State Aid highway is protected with Tuthill Highway Guard. R. M. Lobdell, Lake County Highway Supt., Waukegan, Illinois.

**T**UTHILL is the only steel guard rail that transmits impact through leaf springs to the *base* of the posts. It deflects vehicles without damage to the vehicle, its occupants or the highway guard. Most economical in the long run (or the short stop).

**TUTHILL SPRING COMPANY**  
760 POLK ST. CHICAGO, ILL.

**Cleveland**  
POINTS WITH PRIDE...

**TO ITS New**  
**CARTER Hotel...**

and you'll look back with pride and satisfaction on a visit to this great hotel where every room is as smart and new as a new day — where comfort and luxury achieve a new meaning — and where both rooms and food are priced surprisingly low.



IN THE CENTER OF DOWNTOWN CLEVELAND

600 ROOMS **\$2.50** EACH WITH BATH

FOLSOM B. TAYLOR Managing Director

# Equipment Purchasing Practices and Rentals

By C. N. Conner

**A**PPROVED methods of purchasing maintenance equipment and of charging for its use are of vital importance to every highway official who is responsible for economical expenditures of the taxpayers' money.

## Purchasing Practices

The methods of purchasing which are employed are many, varied and in some instances are unsound. The following recommendations and opinions will help purchasers and users in deciding what methods to employ. Savings result from sound purchasing practices and wise selection of equipment. Price is important but often subordinate to repair costs and results.

**County Purchase of Equipment.** A joint committee of the American Road Builders' Association and the American Association of State Highway Officials made recommendations in 1931 and 1932, which were accepted in 1932 by the County Highway Officials Division of the former association. These included the following points:

It is practicable and consistent with sound administrative practice to surround purchases involving a substantial expenditure by all the safeguards of formal public lettings. Each state should enact legislation governing equipment purchases, to apply to purchases by state and counties alike.

For purchases in excess of \$1,000, proposals should be received after advertising for a definite period in newspapers and periodicals and mailing notices to all known prospective bidders.

For purchases between \$100 and \$1,000, requests for bids should be sent to a selected list of companies. In both cases proposals should be opened and read publicly at a specified date and hour. For purchases of less than \$100, purchases may be made in the open market by an authorized representative of the county, without receiving bids.

County purchases should be made directly by the county, the choice of equipment being made by the county engineer or county highway superintendent.

In making choice of equipment, the following elements of value should be considered. The order of importance and relative weights given are suggested by the committee, but it is recognized that it may be desirable to vary them to suit particular conditions in a given county.

Order of Importance	Weight	Element of Value
A	100	Your own past experience with similar machines
B	70	Performance record of equipment
C	68	Mechanical details of equipment
D	66	Materials used in equipment
E	64	Efficiency in repair parts service

Modern motorized equipment for transporting men and materials and crushing stone by power has proven practical and economical. A return to primitive and uneconomical methods of breaking stone and performing other maintenance jobs will not solve our economic problems.



F	62	Experience of others with similar machines
G	60	First cost of equipment
H	58	Location of and service rendered by local distributors or agents
I	52	Price of repair parts
J	42	Past performance of bidder
K	40	Length of time products have been on market
L	32	Capacity of plant and ability to make prompt deliveries
M	30	Financial standing
N	26	Number of similar machines manufactured and sold.

Each county should keep service and cost records for each piece of equipment, and be encouraged to exchange and compare these records, purchase prices, experience and service information with other counties. Where difference prevails between prices quoted to counties and to the state, it can usually be accounted for by the larger quantities ordered by the latter.

As general a standardization of details of equipment and parts as possible is desirable in order to increase interchangeability and reduce stocking of spare parts.

**Purchasing Practices of States.** A majority of states budget equipment expenditures and purchase equipment through state purchasing agents or purchasing divisions of their highway department.

In most states the engineer, or his authorized representative, initiates requests for new equipment, appraises the need for it and recommends its purchase. He also determines the kind and make of equipment to be purchased.

Nearly all states maintain cost and service records on equipment and use them as guides for buying new equipment. Also before purchase they require literature describing equipment, and actual demonstrations of machines are required by several. A majority, while not expressing any preferences in method of keeping in touch with equipment on the market, utilize all of the facilities supplied by manufacturers. These include manufacturers' salesmen, distributors' salesmen, mail circulars, catalogs, public advertising, road shows and conventions.

Summarized briefly, new equipment should be bought on a competitive basis, taking into consideration the cost of operation and the adaptability of the unit



quoted for the type of work for which it is required.

Old equipment is disposed of by trade-ins on new equipment, by junking it, and in a few cases by salvage.



### Rentals

**Advantages Claimed for the Rental System.** Whether equipment be owned by the state or county or be hired, the cost of service can most readily be charged against the work on which it is used in the form of rental. This permits equitable distribution of operation and depreciation charges and greatly simplifies computation of them.

Rental rates on each piece of equipment should suffice to properly cover its cost and operation and also provide a sum to replace it when obsolete or depleted. Some believe that rental rates should be higher for privately owned than for state or county-owned equipment.

As an example of practice in tabulating rental prices, the following table was used by one state highway commission in 1932:

**Rental Prices on Trucks  
(July 1st, 1932)**

Make	Type	Operation Per Mile	Depreciation Per Mile	Total Rental
All Pickups	½ T.	\$ .03	\$ .01	\$ .04
Ford & Chevrolet	1½ T.	.06	.02	.08
Other Makes	¾ & 1 T.	.06	.02	.08
" "	1¼ & 1½ T.	.07	.03	.10
" "	2 Ton	.08	.04	.12
" "	2½ Ton	.09	.045	.135
" "	3 Ton	.10	.05	.15
" "	3½ Ton	.12	.055	.175
" "	with Oil Distributor	.14	.06	.20

SPECIAL RATES: Mack 1½ T., GMC 2½ T., White 2½ T., and Republic 2½ T., purchased in 1931 for oil sections are to carry 2 T. rental schedule of 12c. This also applies to future purchases of this class.

It should be the endeavor of every road department to suitably equip every maintenance job, so that a minimum number of equipment units will receive maximum use, and to approve for use only such types as will effect a reduction in maintenance costs. To do this intelligently requires wise purchasing methods and a practical system for distributing operating costs.

**What Rental Rates Include.** The principal charges included in rental rates cover upkeep, depreciation, and in some cases administrative expense. Operating charges include:

1. Average cost of repairs and upkeep.
2. Operation expense, fuel, oil, grease, etc.
3. Fixed charges, which are:
  - (a) Operating depreciation.
  - (b) Idle depreciation.
  - (c) Interest (if privately owned).
  - (d) Taxes (if privately owned).
  - (e) Insurance (if privately owned).
  - (f) Profit (if privately owned).
  - (g) Overhead (if privately owned), storage, administration

**Rental Practices.** From a survey made by a joint committee of the American Road Builders Association and the American Association of State Highway Officials, it was learned that there was little uniformity in rental rates employed by the several states and only general agreement on what the charges should include. In many states complete and systematic practices were in satisfactory operation, but as there was no uniformity between those of different states, exact comparisons of maintenance costs could not be made. The information collected can be summarized as follows:

Twenty-three states favored establishing rates by classes according to size, capacity, etc., and 5 according to make of equipment.

The straight-line method was favored for state-owned equipment by 22 and for privately owned by 10. The diminishing value for state-owned cars by 8 and for privately-owned by 10; the sinking fund method for privately owned by one.

Idle time rate considered unnecessary for state-owned equipment by 18, for privately owned by 12; and necessary for state owned by 8 and for privately owned by 9.

Mileage as a rate basis for automobiles, 10; for trucks and autos, 2. Hour rate for trucks and autos, 7; for trucks only, 9. Day rate for trucks and autos, 5; for trucks only, 2. Monthly rate for autos and trucks, 6; for autos only, 2.

A 10-hour day was favored as a basis by 16; a 9-hour by 1, and 8-hour by 4.

Increased rate for snow removal by 13, no increase by 13.

The committee found it next to impossible to reconcile or equalize the climatic, topographic, and work variables such as to permit full standardization of rates; also, due to the rapid development in equipment and change of construction and maintenance methods, any schedule of standard rates will likely prove obsolete within a very short time; however, basic fundamentals should vary but slightly.

### Highway Work to End the Depression

One of the most ambitious suggestions for ending the depression is that offered by F. W. Erickson, president of the Erickson Engineering Co. and the Erickson Equipment Co. He proposes building a complete system of six-lane super-highways with a 5-foot parking strip in the center, elevated where they pass through cities, and adequately lighted; a system of secondary improved highways reaching to the remote sections of every state; a correlated system of parks, similar to the Westchester County Park system as an adjunct to the super-highways; and a system of correlated landing fields at each city or pleasure resort, connected with the super-highways.

To pay for this, he would sell ten billion dollars' worth of Federal 3½% ten-year bonds, the interest on which would be less than is now paid in doles. To redeem these, he would impose a federal tax of 5 cents a gallon on motor fuel, which would also be used for maintenance of the highways. (Twenty-five or thirty billion gallons of gasoline a year would do it.)

Mr. Erickson has circulated his idea in the form of a mimeographed pamphlet (which is too long for us to reproduce), in which he enlarges upon the plan and defends it with figures and arguments. We suggest that those interested write him for further information at his office, 452 Lexington Ave., New York City.

### Low Contract Costs in Cincinnati

Cincinnati in 1932 let fifty contracts for paving work, at considerably lower unit costs than for many years past. The average unit costs for the last four years and for 1925 show the advantage of profiting by the present low prices in constructing public works.

#### PAVEMENT COSTS

Items	Unit	1925	1929	1930	1931	1932
Grading .....	cu. yd.	\$0.70	\$0.44	\$0.40	\$0.40	\$0.20
Concrete for base.....	cu. yd.	8.90	8.28	7.42	5.90	5.10
7-inch concrete pavement	sq. yd.	2.80	2.53	2.28	2.04	1.71
8-inch concrete pavement	sq. yd.	3.05	2.69	2.46	2.01	1.86
9-inch concrete pavement	sq. yd.	3.40	2.71	2.42	2.10	1.76
Asphalt pavement .....	sq. yd.	2.40	1.36	1.39	1.40	1.30

## Oil-Mix Gravel Surfacing, Using Loose Material on Roadway

By L. D. Townsend,  
Engineer, Washtenaw County, Mich.

The maintenance of gravel road surfaces in Michigan has generally been accomplished by using the considerable loose material upon them to form a mulch, which is worked up with a grader or truck scraper. When such a surface is given a treatment, as an oil-mix, it is the practice to blade or broom this excess material to the side and apply other aggregates in making the mixture.

In constructing several miles of the oil-mix type in Washtenaw County, Michigan, during the past season we were able to salvage all of this loose material and embody it in the surface treatment.

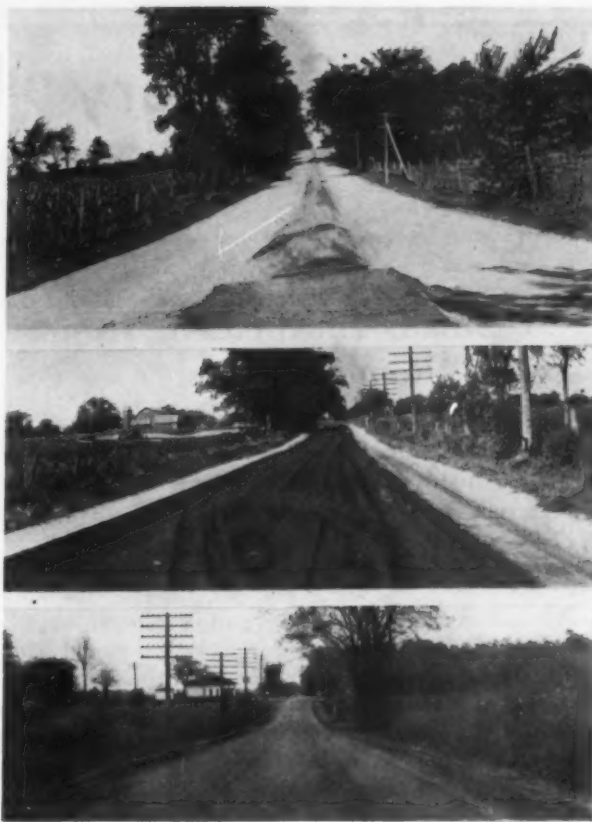
The excess material was brought into the center of the road with a grader so that it formed a windrow sufficiently narrow for the gravel spreader to straddle.

Additional material was then distributed over this windrow, the opening in the spreader being set for the amount of material necessary to make up the deficiency in the amount already in place to secure the prescribed depth of road surfacing.

By previous tests we were fairly sure about the grading of our aggregate; but after distributing, we tested again and added either sand or stone in small amounts to bring the aggregate to the proper analysis.

From this point on the usual methods in putting down an oil-mix road were followed. An oil was used, containing 70 to 75% of asphalt of 100 penetration, and for this particular job was furnished by The Texas Company.

Mixing was done by three methods used in succession. A retread mixer was used first, followed by a spring tooth harrow and a power grader. The retread mixer mixed rapidly and deeply but had a tendency to cause the material to pile up and work to the sides. While in this flattened condition the spring tooth harrow was drawn through it, giving additional mixing at little cost. This was followed with the grader, and the material again brought into the center where the cycle of operation was repeated. This work was repeated and additional oil added until the proper consistency was obtained. The mixed material was laid out with the retread mixer and shaped with the power grader. Traffic was then turned onto the road and allowed to compact the surface. For a few days the



TOP—Windrow of loose material; covered, in the foreground, with the additional material. MIDDLE—Asphalt-gravel after it has been thoroughly mixed and spread. BOTTOM—After thorough compaction by traffic

grader was used to keep the surface smooth and free from ruts.

This type of treatment is easily put down and is comparatively inexpensive because the aggregate is local material and the grade of oil used is nominal in cost, but the thing that appeals most to the public is that it results in an extremely pleasing surface to drive over.

## Highway Guard Rails

Little has been written about highway guard rails, even though in recent years there has been a realization of the necessity for a safe, strong, visible guard for highways.

The accompanying photograph shows where the outer side of a curved bridge approach was protected with a steel guard rail while the inner and less exposed side is adequately served by another type of guard. The curve marks the approach to a bridge over the Sangamon River in Illinois. The bridge superstructure masks the sharpness of the curve from the motorist approaching it, which fact has resulted in many accidents. These have now been largely eliminated by the installation of the rail shown, which has strong spring supports at each post. The rail is fastened to one end of an "S" shaped spring, the other end of the spring being bolted to the posts at the ground level, at which point impact has the least effect on the post. The spring is of such length that the rail is slightly above the center of gravity of the average car. This particular railing was furnished by the Tuthill Spring Co.



Guard rail on approach to Sangamon river bridge.

# Sanitary Engineering

Water Supply — Sewerage — Refuse  
Collection and Disposal—Sanitation

## A Small, Inexpensive Iron Removal Plant

By E. S. Flannery

*Superintendent, City Water Plant, Platte City, Missouri*

In July, 1930, the city of Platte City completed the construction of a water works system consisting of a 75,000-gallon elevated tank and a Cook turbine pump at the well, which was about one-half mile from the tower. The water was pumped from the well across the river into a 5,000-gallon concrete basin under an 8x12 pump house, in which was a Gould triplex pump that pumped the water from this basin into the elevated tank. Each pump is of 75-gallon per minute capacity.

As soon as the system had been completed we began to hear complaints from the users about the water coloring the fixtures and that it could not be used for laundry purposes. Analysis showed that the water had five parts per million of iron. The city had spent at that time \$35,000 and, unless the iron was removed, the water was suitable only for fire protection.

Representatives of companies having patented processes and machinery for eliminating this iron tried to sell their systems at prices ranging from \$4,000 to \$6,000. There was no doubt that their systems were very good, but our city was unable to spend that amount of money for that purpose.

After seeing several water plants in other towns and gathering all the information we could, I constructed a model filter out of a keg in which was placed sand and gravel and a small aerator. A test of this model showed that by such a method and system the iron could be eliminated from the water. We had our engineer make plans of a filter according to our model and send them to the State Board of Health for examination, and they were approved with two or three minor changes.

We constructed a settling basin 8x15 feet, and 10 feet deep, which provides two hours' detention, with a baffle through the center 12 feet long, giving a length of flow of about 27 feet. On the top of this basin we constructed a catch basin 8'x8'x12". The water is sprayed into the air by four nozzles and falls in to this small catch basin, draining from this basin into the settling basin in one corner. After passing through the settling basin it runs onto a filter, which is concrete, 4'x8' and has 24 inches of five grades of gravel, ranging from 1/8 inch to 2 1/2 inches in diameter. On the top of the gravel is 30 inches of filter sand. After the water has run through the filter, it goes into the old 5,000-gallon basin, which we now use for a clear water basin, and from there it is pumped into the mains to the tower. The sand and gravel have not been changed since first being put into the filter. The filter is back washed from the city main about every five or six hours.

This system was constructed by home labor at a cost

of about \$1,650. No complaint has been made by any consumer concerning iron in the water since it has been filtered.

The above is from a paper before the Missouri Water and Sewerage Conference.

## Sewer Rental and Compulsory Sewage Treatment in Ohio

By the end of 1932, 27 Ohio municipalities were operating under sewer rental ordinances, using the income therefrom for financing sewage disposal by direct charges to users of the sewer systems.

Ohio has taken a further forward step in promotion of sewage treatment. The Supreme Court of that state has decided that neither financial distress of a municipality nor the opposition of its voters is sufficient to prevent the Ohio State Department of Health from enforcing its order to compel a city to correct its sewage disposal system in order to eliminate the pollution of a stream. The city of Van Wert must now proceed to carry out the order of the Ohio State Department of Health to cease the pollution of a stream by its sewage, notwithstanding the refusal of the voters to approve a bond issue for the purpose.

## Seven-Yd. Refuse Collection Equipment for Baltimore

The city of Baltimore has recently purchased a refuse collection truck, the body of which, although only 10 ft. long, has a capacity of 5 cu. yd. to the loading line and 7 cu. yd. fully loaded with the sides closed. The short length of body makes it convenient for use in congested streets. The capacity is secured by depressing the floor below the top of the chassis frame, which also permits giving a loading height of only 60 inches above the road surface. The body, which is known as the Trenton refuse body, is carried on a 2 1/2-ton truck.



*Baltimore's new refuse collection truck*



## SAFEGUARD THE PRECIOUS WATER SUPPLY

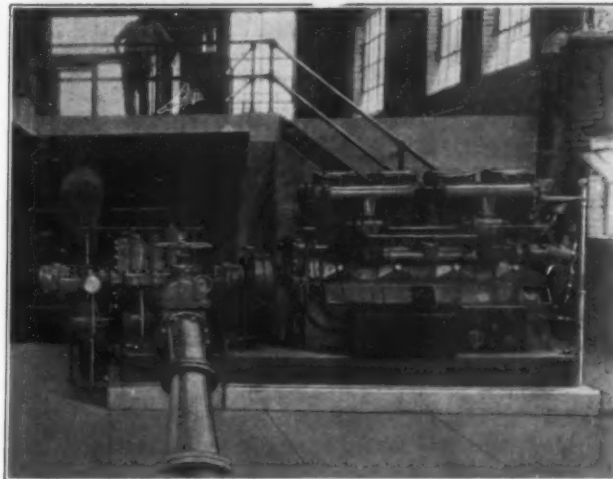
Invaluable for fire duty, necessary for domestic use

Sterling  
High  
Duty



Internal  
Combustion  
Engines

12 to 565 B.H.P.  
Gas or gasoline



Dolphin "straight eight" cylinder 290 HP, 1450 RPM, Sterling engine driving an Allis-Chalmers 8" NYC cent. pump for fire protection at Paris, Texas.

A booklet entitled "What is the difference" mailed on request, will in seven minutes acquaint you with what you want to know about engines for "standby."

## STERLING ENGINE COMPANY

Home Office and Plant  
1270 NIAGARA ST.  
BUFFALO, N. Y.

DEPT. C-5

Branch Office  
900 CHRYSLER BLDG.,  
NEW YORK, N. Y.

### For Sewage and Water Treatment

"ISCO"

#### Ferric Chloride

Solution or Crystal

**For Sludge Conditioning.** Ferric Chloride has been accepted as the most efficient agent from the standpoint of quantity and cost.

**For Coagulating Sewage.** Ferric Chloride provides an inexpensive and effective method of dealing with plant overloads.

**For Water Filtration.** Ferric Chloride is an economical and practical coagulant. It gives a quick forming, fast settling floc.

"ISCO"

#### Chlorinated Lime

Use "Isco" Chlorinated Lime for water and sewage treatment.

**No deadly gas danger.**

**No expensive equipment needed.**

**No containers to return.**

Chlorinated Lime gives best results for sterilizing sewage effluent.

Distributors for **Cliff Char Activated Carbon** in various forms and grades for all purposes

**Write for list of articles giving experiences of many plants in the use of FERRIC CHLORIDE**

### INNIS, SPEIDEN & CO.

117 Liberty Street

New York, N. Y.

The sides are fully enclosed with four roll-type metal curtains, any or all of which can be open or closed at one time. The floor and tail gate are water tight, a gasket being fitted to the latter to secure this; while the floor is of heavy copper-bearing steel to resist action of acids in garbage as well as rust. The body is dumped by means of a hoist.

## Prechlorination of Sewage for Odor Control

The sewage of Marceline, Mo., is treated in two plants, one serving about 1800 people and one about 900. The former consists of two Imhoff tanks and sludge drying beds, the latter of one tank and bed. All of the larger plant is enclosed, the beds with a glass enclosure, the tank with a tile brick building.

When the larger plant was first put in operation in 1923, about 4 lb. per 24 hrs. of chlorine was added to the effluent, but there was considerable odor. In 1926 the chlorinator was moved to apply the chlorine to the influent near the plant and the dose increased, to 10 lbs. in the spring and as much as 20 lbs. in very hot, dry weather, and no more odor trouble was experienced, and the residual chlorine of the plant effluent averages 0.2 p.p.m., but varies widely.

At the smaller plant also, chlorine application was changed from effluent to influent and gas fed to the bottom of a pit 8 ft. deep and odor largely eliminated. However, with feed as low as 5 lbs. per 24 hrs. chlorine bubbled to the surface, and the chlorination was changed to solution feed, and the point of application changed to a point 1500 feet above the plant. This gives very satisfactory results. When feeding 13 lbs. per 24 hrs. there is strong residual chlorine in the plant effluent.

The cost of chlorine for the two plants for the 7 months, April 1st to November 1st, during which it is used, averages \$45 a month with chlorine at 9 cents per pound.

The above information is from a paper by G. C. Fox, superintendent of water and sewage treatment plants at Marceline, before the Missouri Water and Sewerage Conference.

## Activated Carbon in Missouri

Reports of experiences of two Missouri water supplies, Cameron and Moberly, in the use of activated carbon were told at the eighth annual Missouri Water and Sewerage Conference by Frank E. Turner and Carl Haynes, water superintendents of these cities.

Cameron takes its water from an impounding reservoir through one outlet, near the bottom, and when the lake is full there is always a bad taste and odor to water. Ammonia had been used for two years and removed the chlorine taste, but not the algae or fishy taste. Last summer hydrogen sulphide was very pronounced, and while the aerator removed some of it, considerable was left and activated carbon was tried as a remedy, beginning July 1st. At first the carbon was fed just ahead of the filters but it shortened the filter runs too much. Then it was mixed with the lime in the mechanical mixing chamber and the mixture fed with a dry feed machine. This, Mr. Turner said, has been very successful, taking out all of the taste and odor. The carbon is applied at the rate of 0.1 grain per gallon, making the cost \$1.57 per million gallons. No change has been noticed in the chlorine demand or in the amount of alum required.

At Moberly, prechlorination and ammoniation had failed to remove a rotten wood taste, using 10 lbs. of liquid chlorine and 3 lbs. of ammonia in 500,000 gals. of water. Some activated carbon was fed into the water through the alum machine but the results were not very satisfactory, nor was throwing it in by hand around the intake to the settling basins. Then Mr. Haynes used a 50-gallon barrel with a quarter-inch copper pipe outlet at the bottom, discharging into the outlet end of the settling basins where the water flowed onto the filters. One pound of carbon was placed in 50 gals. of water and stirred with a paddle every 20 minutes. This eliminated the odor. This barrel has since been replaced with a metal box 2x2x3 ft. Over this is mounted a water wheel with a vertical shaft, on the bottom of which are fastened paddles which keep the carbon mixed thoroughly. A petcock in one side just above the bottom serves as outlet and discharges the carbon solution into the settling basins just over the intake to the filters. One pound of activated carbon to 50 gallons of water is the mixture used. When odors are not present 0.04 grain per gallon is used; when algae or similar odors are noticed this is increased, up to 0.4 grain being used. The result is a water with a sparkling color and pleasant taste.

## Accident Hazards at Sewage Plants

A conference was held this spring between the Bureau of Sanitary Engineering, California Dept. of Public Health, and the Industrial Accident Commission relative to the elimination of hazards in sewage treatment works. It was brought out that an operator of treatment works in southern California was killed recently by sewer gases in the bottom of an Imhoff tank. Two men were recently killed by sewer gas in a man-hole at El Centro. Explosions of sewer gas are of common occurrence. Many mechanical hazards around sewage treatment plans also are found very often. Steps are being taken to bring these matters to the attention of municipal authorities and operators. They can all be eliminated through the establishment of proper safeguards.

## Cost of Street Cleaning in Cincinnati

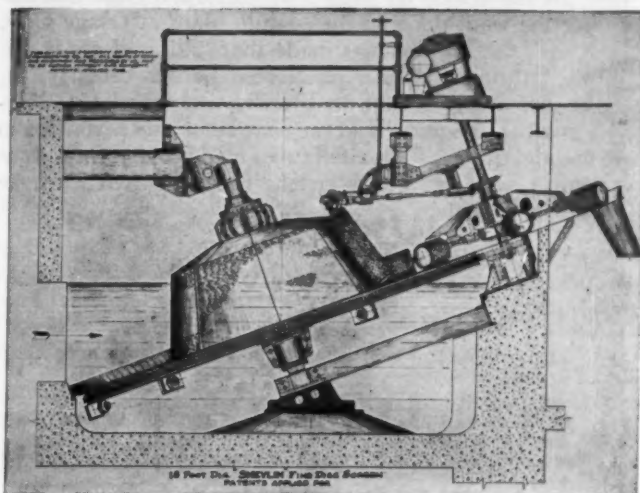
At the beginning of 1932, most of the equipment used by the city of Cincinnati for street cleaning was horse-drawn; but early in the year motor equipment was purchased, and at the close of the year the maintenance division had only eight horses.

In order to provide uniform employment for the outside personnel of the division, the 5-day week of 8 hours a day was in effect the entire year.

Some of the unit costs, which include labor, equipment rental, materials and supplies, were as follows:

	Length	Cost
Street cleaning — machine brooming .....	6,800 mi.	\$2.65 per mi.
Street cleaning — hand brooming .....	26,600 "	1.43 " "
Street cleaning — machine flushing .....	17,700 "	0.72 " "
Pavement repair — sheet asphalt .....	182,000 sq. yd.	0.71 per sq. yd.
Pavement repair — bitum. concrete .....	575,000 " "	0.25 " " "
Pavement repair — block ...	21,000 " "	1.76 " " "
Pavement maint. — crack filling .....	1,960,000 ft.	0.004 per ft.
Pavement maint. — cutting expansion joints .....	363,000 "	0.007 " "
Sewer cleaning — inlets and catch basins .....	68,400	0.43 each

## SHEVLIN FINE DISC SCREENS



**Improved features found in  
no other disc screen**

VARIABLE SPEEDS . . . SELF ALIGNING MAIN SUSPENSION BEARING  
ADJUSTABLE SLOPING SEALS . . . MAXIMUM SCREENING AREA  
SCREENINGS DELIVERED SUITABLE FOR INCINERATION

**RUGGED, DEPENDABLE  
AND AT REASONABLE PRICES**

Shevlin screens have been modified from the original German design to meet the American conditions and to stand more severe operating conditions than the R. W. type of screen.

**SHEVLIN ENGINEERING COMPANY, INC.**  
227 FULTON ST. NEW YORK, N. Y.

## Guest Satisfaction...

IS NOW A  
CERTAINTY WITH  
**VISUAL SELLING  
BY PHOTOGRAPHS**

Six attractive red-uniformed girls are the new front-office staff at the Roosevelt. You select the room you wish from a series of actual photographic reproductions.

IN THE CENTER OF  
THE TRIANGLE IN

**PITTSBURGH**

600 ROOMS WITH BATH  
150 New Rooms at \$2.50 with Bath

Direction: AMERICAN HOTELS CORPORATION  
FRANCIS W. PARKE, Manager

**ROOSEVELT HOTEL**



# SIMPLEX



Simplex  
Indicating  
Recording  
Totalizing  
Meter Register

Venturi Type Meters  
Effluent Controllers  
Filtration Plant Gauges  
Water Works Specialties

WRITE FOR  
BULLETINS

**SIMPLEX VALVE & METER CO.**

2017 South 68th Street  
Philadelphia, Pa.

## Water Filters and Filtration Plant Equipment

*for Domestic and Industrial Service*

SWIMMING POOL FILTERS AND RECIRCULATING  
PLANTS

EQUIPMENT FOR SEWAGE TREATMENT PLANTS  
AND PUMPING STATIONS

We serve as skilled contractors to furnish and install the complete equipment, piping, etc., in all forms of water and sewage plants.

**ROBERTS FILTER MFG. COMPANY**  
640 COLUMBIA AVE. DARBY, PENNA.

## Use PFT Equipment for Sewage, Water and Industrial Waste Treatment

*Write for Latest Bulletins*

**PACIFIC FLUSH TANK COMPANY**  
Designers & Manufacturers of Sewerage and Sewage  
Treatment Equipment

4241  
RAVENSWOOD AVE.  
CHICAGO, ILL.

EXCLUSIVELY  
SINCE 1893

136  
LIBERTY STREET  
NEW YORK, N.Y.



**A warm welcome  
to PHILADELPHIA**

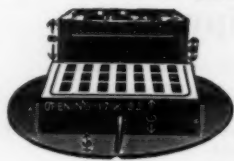
- EACH ROOM WITH BATH
- FRENCH RESTAURANT.
- COFFEE GRILL ....
- ROOF GARDEN ....

**400 ROOMS**  
FROM \$3.<sup>50</sup> SINGLE  
FROM \$5.<sup>00</sup> DOUBLE

ADELPHIA HOTEL CO.  
DAVID B. PROVAN,  
Managing Director

**HOTEL ADELPHIA**  
CHESTNUT AT 13<sup>TH</sup> ST.

**STREET, SEWER AND WATER CASTINGS**  
Made of wear-resisting chilled iron in various styles,  
sizes and weights.



MANHOLE COVERS  
WATER METER COVERS  
ADJUSTABLE CURB INLETS  
GUTTER CROSSING PLATES  
VALVE AND LAMPHOLE COVERS

Write for Catalog and Prices

**SOUTH BEND FOUNDRY CO.**

All Kinds of Gray Iron Castings  
SOUTH BEND, IND.

**POCKET LIBRARY of**

**"Sanitary Engineering"**

By W. A. HARDENBERGH  
Associate Editor of PUBLIC WORKS

COMPLETE in three handy volumes, these books cover adequately but briefly the essential data regarding *Water Supply, Sewerage, Water Purification, Sewage Treatment and Municipal Refuse*. Attractively bound in blue, semi-flexible covers. Sent postpaid for \$5.00.

Order Today From

THE BOOK DEPT. OF PUBLIC WORKS  
310 EAST 45TH ST. NEW YORK, N. Y.

When you write—please mention PUBLIC WORKS

## Rehabilitation of Osage City Sewage Works

In the article on page 9 of our April issue describing the work done on the sewage plant at Osage City, Kans., the statement is made that "diffused air is applied through a grid of Norton porous tubes." Mr. Veatch writes us that the specification called for "Norton tubes or equal," and the contractor was permitted to use and did use "Aloxite" tubes made by the Carborundum Company; which fact he had forgotten when he wrote the article.

## The Water Wheel

(Continued from page 16)

33. Fire Hydrants Assembled in Water Department Shop (Philadelphia). Seth M. Van Loan, pp. 413-414.
34. Long Cast-Iron Main Taps New Well Field, pp. 487-490.
35. Modern Filter Plant in China Built by Coolie Labor. Ellwood H. Aldrich, pp. 490-491.
- The Surveyor and Municipal and County Engineer, March 31.*
36. Ozone Treatment of Water, p. 364.
37. Economy in Water Treatment—Mechanical Flocculators, p. 371.
38. Water Filtration at Perth. Cyril Walmesley, p. 370.
39. Notes on Reservoir Failures. John M. Hogg, pp. 375-376.
- The Water Tower, April.*
40. Colonial Elevated Tank Installed at Tallahassee, p. 3.
41. n. Butt Welded Standpipe at Lititz, Pa., p. 6.
42. n. Niagara Falls Installs Washwater Tank at New Filtration Plant, p. 7.
- The Canadian Engineer, March 28.*
43. Methods of Charging for Domestic Water Supplies. Ross L. Dobbin, pp. 44-45.
44. Flat Rate. W. L. McFaul and G. G. Routtedze, pp. 45-46.
45. Meter Rate Method of Charging. T. H. Hooper, pp. 46-48.
46. Meter Rates in Windsor, Ont. Gilbert C. Storey, pp. 49-53.
47. Design and Installation of Large Water Mains. C. J. Des Balleys, pp. 54-58.
48. Operation of Water Filtration Plants. Norman J. Howard, pp. 65-66.
49. Operation of Brantford Filtration Plant. F. P. Adams, pp. 66-67.
50. Operation of Ottawa Purification Plant. H. P. Stockwell, pp. 67-70.
51. Water Purification Plant at St. Thomas. W. C. Miller, pp. 72-75.
52. Water Filtration Plant at Border Cities. J. Clark Keith, pp. 75-78.
53. Construction of Intake Pipe and Junction Shaft for City of Toronto Duplicate Water Supply. F. W. Douglas, pp. 78-84.
- Proceedings, Am. Soc. of Civil Engineers, April.*
54. High Dams on Pervious Glacial Drift. Edward M. Burd, pp. 537-561.
55. Forests and Stream Flow. Discussion. Herman Stabler, H. S. Gilman, pp. 607-616.
56. Tests for Hydraulic-Fill Dams. Discussion. D. P. Kryne, M. M. O'Shaughnessy, pp. 617-620.
- Water Works and Sewerage, April.*
57. Operating Conditions at the Athens, Greece, Water Purification Plant. Louis A. Geupel, pp. 113-116.
58. Selling the Water Works to the Public. A. F. Porzellus, pp. 121-122.
59. Turbidity Determinations. John R. Baylis, pp. 125-128.
60. Clarification of Water Supplies by Filtration through Anthracite. Homer G. Turner and G. S. Scott, pp. 135-136.
61. Water Supply for Tanneries. Aug. C. Orthmann, pp. 138-140.
- American City, April.*
62. Rebuilt Water Works Includes Softening. E. L. Lium, pp. 43-45.
63. The War on Mud Balls. Edward S. Hopkins, pp. 57-59.
- Journal, American Water Works Association, March.*
64. Financing Public Utilities. H. A. Van Norman, pp. 315-320.
65. Solving a Suction Lift Problem in an Automatic Pumping Station. Edward I. McCaffery, pp. 321-326.
66. Location Record for Distribution System. A. H. Miller, pp. 327-336.
67. Experiences with Well Water in an Uncovered Reservoir. K. W. Brown, pp. 337-342.
68. Rate Making Under Present Economic Conditions. N. T. Veatch, Jr., pp. 343-354.
69. Unusual Features of the Rodriguez Dam Construction. Charles P. Williams, pp. 355-366.
70. Germicidal Effectiveness of Chlorine, Bromine and Iodine. T. D. Beckwith and J. R. Moser, pp. 367-374.
71. An Analysis of Metered Revenue. P. J. Dishner, pp. 375-379.
72. Iodine in Water Supply. J. S. McHargue and D. W. Young, pp. 380-382.
73. A Comparison of Three Methods of Determining the Colon-Aerogenes Group. August G. Nolte and Warren A. Kramer, pp. 383-389.
74. Ammoniation Practice in the East. William J. Orghard, pp. 390-395.
75. Cross Connections. Report of Committee No. 8, pp. 396-443.

## American Water Works Association

The annual convention of the American Water Works Association will be held at Chicago, Ill., June 12 to 16. Headquarters and exhibits will be at the Hotel Sherman.

The program of the meeting has not yet been announced.

The Exhibit Contest, which was so successful last year at the Memphis meeting, will be repeated in substantially the same form as last year. There will be three prizes to exhibitors, and three to the active members who report most intelligently on the exhibits. No exhibitor may win first prize two years in succession.

Other forthcoming meetings of the Association are as follows:

September 25-27, 1933—Wisconsin Section, A.W.W.A., to be held at the Hotel Schroeder, Milwaukee, Wis. Secretary, L. A. Smith, Superintendent of Water Works, City Hall, Madison, Wis. (One joint session will be held with the American Society of Municipal Engineers).

October, 1933—California Section, A.W.W.A., to be held at the Hotel Oakland, Oakland, Calif. Secretary, R. F. Brown, California Water Service Co., Stockton, Calif. (The exact dates will be announced later).

October 26-28, 1933—Missouri Valley Section, A.W.W.A., to be held in St. Louis, Mo. Secretary, E. L. Waterman, Professor of Sanitary Engineering, University of Iowa, Iowa City, Ia.

November 6-8, 1933—North Carolina Section, A.W.W.A., to be held at the Hotel Vance, Statesville, N. C. Secretary, H. G. Baity, Professor of Sanitary and Municipal Engineering, University of North Carolina, Chapel Hill, N. C.

### Reports and Books Available:

Application of the Activated Sludge Process to the Treatment of Milk Products Waste. Report, Nov., 1932, of Michigan Engineering Experiment Station, East Lansing, Mich.

Recommended Laboratory Methods of Analysis for Michigan Sewage Treatment Plants. Jan., 1933, of Michigan Engineering Experiment Station, East Lansing, Mich.

Modern pH and Chlorine Control. A valuable 54-page book published by W. A. Taylor & Co., Inc., 872 Linden Ave., Baltimore, Md.

Standard Methods of Water Analysis. For sale by the American Public Health Association, 450 Seventh Ave., N. Y.

### Catalogs and Booklets:

Kinney Heaters and Distributors. A 24-page catalog describing Kinney distributors and trailer units. We believe that any engineer having the supervision of bituminous road construction should have this Bulletin. Kinney Mfg. Co., Boston, Mass.

American Bitumuls Co., San Francisco, Calif. 2 bulletins on road construction: The Bulletin on Penetration Pavements contains interesting data developed by research regarding the sta-

bility of penetration types for road and street improvements and explains proven methods of construction with asphalt emulsion. The Bulletin on Maintenance is more general in character and discusses penetration, maintenance, premixes, as well as other methods which are in vogue in many parts of the country.

Highway Guard Rail Fitting, a 12-page data book giving much information in this field. Eastern Malleable Iron Co., Troy, N. Y.

Barrett Road Book is just about the most in the smallest volume that the road builder can get. 48 pages, about 4 inches by 6 inches. Full of tables, data, and just how to do it. Barrett Co., 40 Rector Street, N. Y.

Sanitary Engineering Booklets and Folders from the Municipal Sanitary Service Corp., 155 East 44th St., N. Y., as follows: Vacuum filter for sewage sludge; vacuum filter for sewage filtration; pneumatic ejectors; fine screens; screenings incinerators; and Schofield bar and fine screens.

Plastic Masonry Mortar—Cobbment for leakless masonry. Glencoe Lime and Cement Co., 1608 Pine St., St. Louis, Mo.

"Curing Modern Concrete Roads." 20-page bulletin recently issued by the Philadelphia Quartz Co., Philadelphia. It covers the development of curing with silicate of soda from the road laid in Dallas County, Texas, in 1918 to present day construction in all parts of the country. In addition the advantages and cost of silicate curing, and the instructions for application are reviewed. The bulletin is well illustrated.

## Gasoline Engine Driven Manhole Ventilator

For ventilating and driving off obnoxious gases from manholes, tunnels and other enclosed places where electric power is not available, a gasoline engine driven blower has recently been placed on the market by the Coppus Engineering Corporation of Worcester, Mass.

It is powered by a  $\frac{3}{4}$  h.p. air cooled gasoline engine, operating at 1800 r.p.m., and delivers 1550 cubic feet of air per minute. By means of an 8 in. diameter flexible tubing, of proper



Coppus Manhole Ventilator

length, the air flow can be directed to any desired point. An adjustable discharge eliminates elbows in this duct.

The entire device weighs but 105 pounds and can easily be carried around and set up on any space two feet square, or larger, for ventilating cable manholes, tunnels, pipe galleries, underground passages, coal pockets, shipholds, process tanks, etc.

## A New Liquid Sampler for Sewage

The Chicago Pump Company, Chicago, Ill., have added another unit to their line of equipment for Sewage Treatment Plants. This device, known as a True-Test Liquid Sampler, auto-



New Liquid Sampler

matically takes samples of various types of material for analysis.

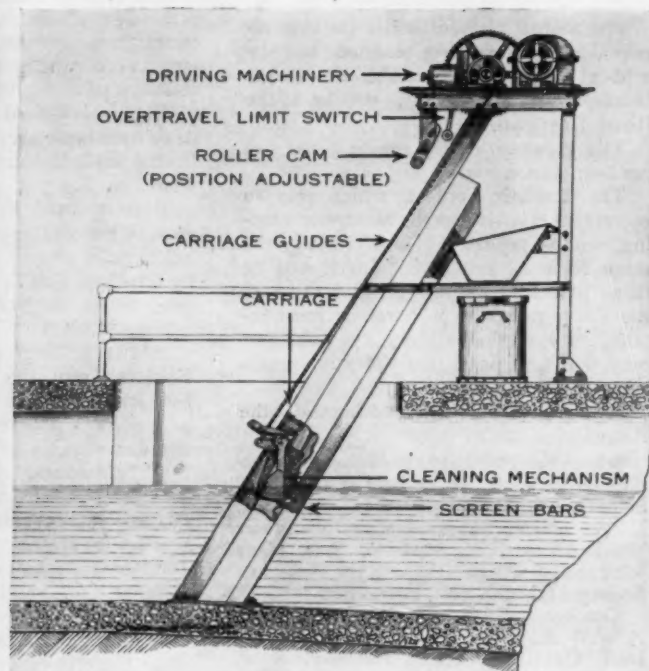
The speed of this machine can be adjusted to take samples of the liquid every 2, 3, 4 or 5 minutes as desired, assuring an accurate composite sample at the end of the day.

It is simple in design and has no complicated parts that require constant attention. The initial cost is low, and operation requires only 40 to 50 watts.

## The Brush Aerator

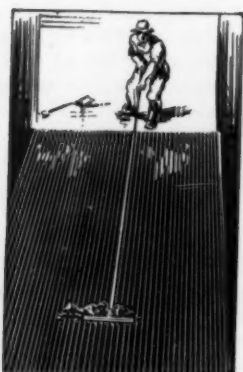
Row Engineers, Inc., 30 Church St., N. Y., have brought out the brush aerator, a new and improved method of mechanically aerating sewage. It consists of a mechanically driven brush, rotating so as to form a spray on the surface of the aeration tanks. Its rotation also sets up a spiral flow through the tanks and insures complete and uniform aeration. It is low in first cost, and economical in operation. Its efficiency has been proven in installations in this country and abroad. Descriptions of such installations appeared in PUBLIC WORKS in the April, July and August issues of 1928. A plant is now being built at Marlboro, N. J., which will employ these aerator units.

Little Talks with  
Sewage Plant Designers



The rugged and simple construction of the Link-Belt Straightline Screen, and its provisions for the avoidance of jamming, assure efficient, constant automatic removal of refuse. It can be furnished either in the inclined type, as shown, or vertical for deep inlet conditions.

## Do you get CHUMMY with Plant Operators?



No longer is this unpleasant, drudging hand cleaning of bar screens necessary. Do it mechanically with a Link-Belt Straightline Bar Screen.

Do you get chummy with plant operators at every opportunity, and learn how the different features of their plants impress them?

You know their reactions to these impressions determine whether the plants you design are to be successes or failures.

The next time you visit a plant that has a hand-cleaned screen, get the operator's "low down" on it. Find out how often he cleans it (actually, not theoretically); and how much (or little) material has to collect on the screen before the head of the backed-up sewage pushes it through. Find out how he likes raking up the heavy stuff, and how much of his time it takes from his other duties.

Then find out how he reacts to the idea of a Link-Belt Mechanically Cleaned **STRAIGHTLINE** Screen. Send for Bulletin No. 1287.

4694

### LINK-BELT COMPANY

Leading Manufacturers of  
Equipment for handling Materials Mechanically and for the Positive Transmission of Power

PHILADELPHIA, 2045 West Hunting Park Avenue

SAN FRANCISCO, 400 Paul Ave.

CHICAGO, 300 West Pershing Road

TORONTO, Eastern Ave. & Leslie St.

Offices in Principal Cities

# LINK-BELT

SCREENS ▲ COLLECTORS ▲ AERATORS ▲ GRIT CHAMBERS ▲ DISTRIBUTORS

See Our Exhibit at A Century of Progress, Chicago, June 1, to Nov. 1, 1933

For latest catalogs—consult the classified INDUSTRIAL LITERATURE section, beginning on page 43



# THE DIRECTORY OF CONSULTING ENGINEERS

JOHN W. ALVORD  
CHARLES B. BURDICK  
LOUIS R. HOWSON  
DONALD H. MAXWELL

## ALVORD, BURDICK & HOWSON *Engineers*

Water Works, Water Purification,  
Flood Relief, Sewerage, Sewage Dis-  
posal, Drainage, Appraisals, Power  
Generation

Civic Opera Building Chicago

## FLOYD G. BROWNE

*Sanitary Engineer*

Reports Design Operation  
Technical Supervision

Water Works — Sewage Treatment  
Works — Industrial Wastes Treat-  
ment — Laboratory Analyses

Marion, Ohio

## A. W. DOW

*Chemical Engineer*

Consulting Paving Engineer

Mem. Am. Inst. Ch. Engrs.

Asphalt, Bitumens, Paving, Hydraulic  
Cement, Engineering Materials.

801 Second Avenue New York

## AMBURSEN CONSTRUCTION CO., INC.

*Engineers and Constructors of  
Ambursen Dams.*

Specialists in difficult hydraulic work,  
water-supply and irrigation dams,  
and hydro-electric plants.

295 Madison Ave. New York City

## BURNS & McDONNELL ENGINEERING CO.

McDonnell-Smith-Baldwin-Lambert

*Consulting Engineers*

Lighting, Appraisals,  
Waterworks, Sewage,  
Rate Investigations.

Kansas City, Mo. Interstate Bldg.  
Los Angeles, Cal. West. Pacific Bldg.

## HENRY E. ELROD

*Consulting Engineer*

Mem. American Society of Civil Engineers

Mem. American Society of Mechanical Engineers

Water Purification—Sewage Treatment

Utility Appraisals—Rate Regulation

Petroleum Building Houston, Tex.

## BABCOCK BROTHERS

*Consulting Engineers*

Specializing in Concrete Bridges  
and Viaducts

Steel Bridges, reports, surveys and in-  
vestigations of Statically Indetermi-  
nate structures by the Beggs Deform-  
eter Method.

DUDLEY P. BABCOCK  
HENRY G. BABCOCK

55 West 42nd Street New York

## JAMES M. CAIRD

Assoc. Am. Soc. C. E.

*Chemist and*

*Bacteriologist*

Water Analysis and Tests of Filter  
Plants

Office and Laboratory:

Cannon Bldg., Broadway & 2nd St.  
Troy, N. Y.

## FULLER & EVERETT

*Hydraulic and Sanitary  
Engineers*

Water Supply, Sewerage, Drainage,  
Valuations, Plans, Supervision of  
Construction and Operation

W. E. FULLER C. M. EVERETT  
L. N. BABBITT

25 W. 43rd Street New York City

## BARSTOW & McCURDY

Incorporated

*Civil and Sanitary  
Engineers*

E. D. Barstow G. E. McCurdy  
A. LeFeber W. S. Mathews

Sewerage and Sewage Disposal  
Water Supply Municipal Engineers

Mendenhall Building Akron, Ohio  
626 Broadway Cincinnati, Ohio

## H. BURDETT CLEVELAND

*Consulting Sanitary  
Engineer*

Water Supply & Purification Design  
Sewerage & Sewage Disposal Reports  
Refuse Disposal Consultation  
Treatment of Investigation  
Industrial Evolution of Works  
Wastes Supervision of Construction

90 Wall St. New York

## FULLER & McCLINTOCK

*Engineers*

George W. Fuller James R. McClintock  
F. G. Cunningham E. W. Whitlock  
C. A. Emerson, Jr. Elmer G. Manahan  
W. Donaldson

Water Supply, Water Purification,  
Sewerage, Sewage Disposal, Garbage  
and Industrial Wastes Problems, Val-  
uation and Rate Regulation of Public  
Utilities.

New York, 170 Broadway

## BLACK & VEATCH

*Consulting Engineers*

Sewerage, Sewage Disposal, Water  
Supply, Water Purification, Electric  
Lighting, Power Plants, Valuations,  
Special Investigation, Reports and  
Laboratory

E. B. Black N. T. Veatch, Jr.

Mutual Building, Kansas City, Mo.

## ROBERT CRAMER

*Consulting Engineer*

Sewage Disposal Plants and Sewerage  
Systems, Utilization and Disposal of  
Industrial Wastes, Power Plants,  
Design, Construction, Operation,  
Laboratory Service, Valua-  
tions and Reports.

647 W. Virginia St., Milwaukee, Wis.

## HOWARD R. GREEN CO.

*Consulting Engineers*

DESIGN, SUPERVISION AND MAN-  
AGEMENT OF MUNICIPAL  
IMPROVEMENTS

Pavements, Sewerage, Water Supply,  
Investigations and Reports

208-210 Bever Bldg. Cedar Rapids, Ia.

## THE DIRECTORY OF CONSULTING ENGINEERS

<p><b>C. N. HARRUB ENGR. CO.</b> <i>Civil and Sanitary Engineers</i> Member of Am. Soc. C. E. Water Supply, Sewerage, Paving and Structural Improvements 712 Amer. Nat'l Bank Bldg. Nashville, Tenn.</p>	<p><b>PEARSE, GREELEY &amp; HANSEN</b> <i>Hydraulic and Sanitary Engineers</i> Reports, Designs, Supervision, Appraisals, Water Supply, Sewage, Water Purification, Sewage Treatment, Refuse Disposal. 6 No. Michigan Avenue, Chicago, Ill</p>	<p><b>HENRY W. TAYLOR</b> <i>Consulting Engineer</i> Water Supply, Sewerage Hydraulic Developments 11 Park Place, New York City</p>
<p><b>NICHOLAS S. HILL, JR.</b> <i>Consulting Engineer</i> Water Supply Sewage Disposal Hydraulic Developments Reports, Investigations, Valuations, Rates, Design, Construction, Operation. Management, Chemical and Biological Laboratories. 112 East 19th Street New York City</p>	<p><b>MALCOLM PIRNIE</b> <i>Engineer</i> Malcolm Pirnie Charles F. Ruff Water Supply, Treatment, Sewerage, Reports, Plans, Estimates, Supervision and Operation, Valuation and Rates. 25 W. 43rd St. New York, N. Y.</p>	<p><b>EDWARD THOMAS</b> <i>Attorney at Law</i> Consultant on Municipal Patent Litigation Woolworth Bldg. New York, N. Y.</p>
<p><b>METCALF &amp; EDDY</b> <i>Engineers</i> Harrison P. Eddy John P. Wentworth Chas. W. Sherman Harrison P. Eddy, Jr. Almon L. Fales Arthur L. Shaw Frank A. Marston E. Sherman Chase Water, Sewage, Drainage, Refuse and Industrial Wastes Problems Laboratory, Valuations Statler Building Boston</p>	<p><b>ALEXANDER POTTER</b> <i>Civil and Sanitary Engineer</i> Specialties: Water Supply, Sewerage and Pavements Phone Cortlandt 3195 50 Church St. New York City</p>	<p><b>WIEDEMAN AND SINGLETON</b> <i>Engineers</i> Water Supply, Water Purification, Sewerage, Sewage Disposal, Investigations, Designs, Supervision of Construction and Operation, Valuations and Reports Candler Bldg. Atlanta</p>
<p><b>PAULETTE &amp; WILSON ENGINEERING COMPANY</b> <i>Professional Engineers Utility Accountants</i> R. J. Paulette Murray A. Wilson MUNICIPAL IMPROVEMENTS PUBLIC UTILITIES INVESTIGATIONS APPRAISALS RATE STUDIES 448 So. 8th St. Salina, Kan.</p>	<p>The Consulting Engineers whose names appear in the Directory are specialists in public improvements—Roads and Streets, Water Supply, Sewerage, Refuse Disposal, City Planning, etc. City, county and state officials who need advice will be able to select from this list engineers to solve their difficulties or carry the work through from its initial stage to a satisfactory conclusion.</p>	



# TO HELP YOU IN YOUR WORK, ANY OF THIS INDUSTRIAL LITERATURE

WILL BE SENT **FREE** UPON REQUEST

★ It is a good practice to check this list regularly because descriptions of new bulletins are always being added.

## Construction Materials and Equipment

### Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

### Asphalt Mixing Plants

10. Precise engineering control of bituminous pavement construction is provided at low initial cost by the new Blaw-Knox (Madsen) portable asphalt mixing plant which is described and illustrated in a new catalog just issued by Blaw-Knox Company, 2019 Farmers Bank Building, Pittsburgh, Pa.

### Asphalt Plants

11. A very complete 24 page booklet covering all five sizes and types of Iroquois Asphalt Mixing Plants which are particularly adapted to meet the needs of municipalities and contractors, providing maximum output at minimum cost. Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.

### Bituminous Paving Machines

25. 32 Miles of Bituminous Roads in 256 Machine Hours and similar feats are described in a 16 page booklet (No. BFF) on Bituminous Road Construction with the Barber-Greene Bituminous Paver and Finisher, issued by the Barber-Greene Co., 635 West Park Ave., Aurora, Ill.

### Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

### Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3 1/2 to 84s size. The Jaeger Machine Company, Columbus, Ohio.

### Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Gallon Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

### Culverts

60. "In diameters up to 10 feet and larger . . ." just issued by the Armco Culvert Mfrs. Assn., tells a good deal about drainage problems and their solution. 32 pages about drainage and multi-plate culverts.

### Graders

76. Latest information about Gallon Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders with hydraulic control is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Gallon Iron Works & Mfg. Co., care of The Jeffry Mfg. Co., Columbus, Ohio.

77. The new "Speed Patrol," so named because of its ability to speed up maintenance work, is illustrated and described in two new booklets just issued by the Tractor Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

### Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Good-year Tire & Rubber Co., Inc., Akron, Ohio.

### Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

### Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

### Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

### Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

### Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the MacMillan Petroleum Corp., El Dorado, Arkansas.

114. Complete information concerning Alabama Asphaltic Limestone will be sent promptly on request to the Alabama Asphaltic Limestone Co., Liberty National Bldg., Birmingham, Ala.

### Road Machinery

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cietrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Gallon Iron Works & Mfg. Co., Gallon, O.

### Rollers

132. A 32-page book in four colors featuring a complete line of road rollers. 8 1/2 x 11, leatherette cover, numerous ac-

## ★ MAIL THIS COUPON FOR INDUSTRIAL LITERATURE

Readers Service Dept.  
PUBLIC WORKS  
310 EAST 45th ST., NEW YORK

Please send me without obligation the following booklets listed in your  
INDUSTRIAL LITERATURE SECTION

(INDICATE BY NUMBERS)

Name .....  
Occupation .....  
Street .....  
City ..... State .....



tion pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses.

134. "The Chief," a six cylinder roller of advanced design and construction is fully described in an illustrated catalog just issued by the Gallon Iron Works & Mfg. Co., care of The Jeffrey Mfg. Co., Columbus, Ohio. Gives complete details of the very latest development by this company.

#### Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

#### Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3210 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines. 910 S. Mich. Ave.

#### Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

#### Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

#### Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

#### Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Hand-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

#### Tractors

170. Everything you want to know about the Model L Allis-Chalmers Tractor is contained in a new 30 page illustrated booklet issued by the Tractor Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

## Road and Street Maintenance

#### Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

#### Asphalt Mixing Plants

10. Precise engineering control of bituminous pavement construction is provided at low initial cost by the new Blaw-Knox (Madsen) portable asphalt mixing plant which is described and illustrated in a new catalog just issued by Blaw-Knox Company, 2019 Farmers Bank Building, Pittsburgh, Pa.

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. "Heating Bituminous Materials" is a new booklet dealing with the problems involved in heating bituminous materials shipped in railroad tank cars and contains full data regarding the Cleaver-Brooks equipment for meeting all heating requirements. Published by Cleaver-Brooks Co., 740 No. Plankinton Ave., Milwaukee, Wis.

#### Distributors

206. Kinney distributors of from 600 to 1,700 gallon tank capacity with heating system and the Kinney jacketed pump having a capacity of over 400 gallons per minute are described in a new catalog just published by the Kinney Mfg. Co., 3529 Washington St., Boston, Mass.

208. "Important Message for Those Road Builders Who Want More for Their Money," a new folder on low-cost roads, and three illustrated bulletins covering their line of asphalt, tar and oil distributors will be sent promptly by E. D. Etynre & Co., Oregon, Ill.

#### Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barborton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

#### Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economics, etc. Sent without cost. Solvay Sales Corporation, New York.

#### Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

#### Surface Heaters

220. The "Hotstuff" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

## Road and Paving Materials

#### Bituminous Materials

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the Macmillan Petroleum Corp., El Dorado, Arkansas.

225. "Enduring Pavements and the Evidence." Everyone should have this data book on the use of lake asphalts. Contains 33 illustrations and list of streets and highways in this country paved with Natural Lake Asphalts. Gives yardages and days laid. Issued by the Barber Asphalt Co., 600 Arch St., Philadelphia, Pa.

226. Full details concerning the uses and advantages of Lincolnte Pulverized Petroleum Asphalt, Linco Road Oils, Cut-back Asphalt Cement and Penetration Asphalt Cements will be sent free on request by Lincoln Oil Refining Co., Box 251, Robinson, Ill.

227. "Asphalt for Every Purpose" a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvalithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

229A. Surface Treatment Types, Asphalt Road Construction Manual No. 2. Full details on surface treatments. 14 chapters, 128 pages. The second of those tremen-

dously valuable and handy little manuals put out by the Asphalt Institute, 801 Second Avenue, N. Y. Sent on request.

#### Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

#### Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

#### Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

#### Jacking Culverts

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

#### Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

## Snow Removal

#### Snow Fences

345. "Standard and Heavy Duty Reversible Blade Snow Plows for Motor Trucks," a new bulletin just published by the Monarch Mfg. Co., East Front St., Wilmington, Del. Illustrated. Contains complete descriptions and specifications.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

359. Gallon Iron Works and Mfg. Co., Gallon, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

## Sanitary Engineering

#### Activated Carbon, Aqua NUCAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 400 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

#### Ferric Chloride

381. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Spelden & Co., 117 Liberty St., New York, N. Y.

383. Loughlin Clarifying Tanks for the more complete removal of suspended solids from sewage and industrial wastes at lower cost are described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

#### Joining Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Merztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

## Improved Construction and Maintenance Equipment

### New 20,400 Gallon Per Hour Pump

The Chain Belt Company, Milwaukee, announces a new 3" self priming centrifugal pump of the recirculating type, which is automatic in action after the recirculating system is once filled.

This particular size has been developed to provide a pump very close to the same light weight portability of the 2" class, with a greatly increased capacity. The new Rex meets the A.G.C. rating for 3" pumps with capacity to spare. The unit weighs only 385#, it is 34" high and 37" wide, and it is capable of the following capacities:

	Gals. Per Hr.
5 ft. suction lift	20,400
10 ft. suction lift	18,300
15 ft. suction lift	16,500
20 ft. suction lift	14,000
25 ft. suction lift	9,000

It is claimed by the manufacturer that this new type recirculating system will pick up the prime in record time on any suction lift up to 25 feet and it con-



New Chain Belt Pump

tinues to pump with an air leak in the suction line that stops an ordinary centrifugal pump but only reduces the capacity of the Rex.

The impeller is of the open trash type with two blades instead of the customary four. With this new design the pump is capable of handling a high percentage of solids and will pass a sphere up to 1 1/2" in diameter.

The new 3" Speed Primer is completely described in bulletin No. 230, which may be secured by writing this magazine or by addressing the Chain Belt Company, Milwaukee, Wisconsin.

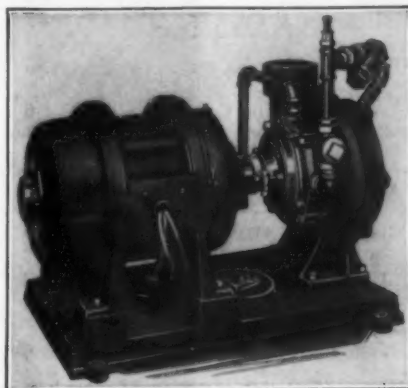
### General Motor Truck

The truck shown on page 50 of our April issue, equipped with Grico Drive unit was a G.M.C.

### A Single Suction Self-Priming Pump

Buffalo Pumps, Inc., Buffalo, N. Y., has designed a completely new single suction pump, with built-in self-primer.

The new pump, which is known as the Buffalo type "CP" is a very compact and economical unit. The casing is cast



Buffalo Self-Priming Pump

iron, and suction side-plate is template-drilled, with close clearance with impeller. Two types of impellers are available; on sump service, or wherever liquids are not clear, the open type is recommended, while for all services where clear liquids are pumped, the enclosed impeller is commonly supplied.

The pump is furnished complete with all necessary fittings and is built in several sizes in capacities up to 450 G.P.M. and for heads up to 150 feet.

### The "Best" Spreader

The "Best" spreader consists of a series of troughs made of 14 gauge metal, the sides of which are 2" high, the combined bottoms of which form a flat, fan-shaped surface designed for the purpose of spreading aggregates from the tail end of a dump truck. The front end which attaches to the truck is 6' wide, the back or discharge end is 8 1/2' wide and the length is 2 1/2'.

It weighs complete with two 5' back end hanging chains, 235 lbs.

The Best spreader will spread sand, gravel, cinders, stone, slag, salt, calcium chloride, chips, etc. It is designed primarily to meet road construction and road maintenance problems.

The instant the truck arrives on the job it is ready to go to work.



The "Best" Spreader

There is no disconnecting delay after truck is empty. The truck time saving alone will more than pay for this spreader in a short period of time. This, plus the fact that there are no moving parts, no repairs, that it is lightest and most easily handled and can be attached to the truck in two minutes, indicates its value.

This equipment is manufactured and sold by D. C. Elphinstone, Inc., 115 So. Calvert St., Baltimore, Md.

### A Grader to Meet Modern Highway Needs

According to The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, the Austin Model 77 is unexcelled in power, traction, range of speed, blade pressure, ease of control and adaptability.

It is powered with a six cylinder motor that develops 53 horse power at governed speed. There are six speeds forward, ranging from 1.39 to 13 M.P.H., to meet every operating need. The full dual drive puts a'1 power to work behind the blade. Four drive wheels grip the road surface to provide freedom from wheel slippage and mirroring. The wide tread permits ditch work and enables one wheel to move along the top of the road while opposite wheel, in the ditch, tracks with rear drivers. A 60" diameter circle provides more leverage when operating the blade and has a five-point support. Wide blade arms are welded to the circle.

The "77" is also built with single drive. All "77" motor graders can be furnished with either hand or hydraulic (oil) power controls; the "77" Dual Drive Motor Grader can be furnished with Diesel motor.

Extra equipment, including special blades, boots, extensions, etc., scarifier, power drag attachment, tire pump, snow plow, head and tail lights, etc., are available to meet every operating condition.



Austin "77" Grader



## Index to Advertisements

Adelphia Hotel .....	38	Elrod, Henry E. ....	41	Pacific Flush Tank Co. ....	37
Alvord, Burdick & Howson ...	41	E. D. Etnyre & Co. ....	30	Paulette & Wilson Engr. Co. ...	42
Ambursen Constr. Co. ....	41	Filtration Equipment Co. ....	47	Pearse, Greely & Hansen. ....	42
Armco Culvert Mfrs. Assn. ....	3	Frink, Mfr., Carl. ....	4	Piccadilly Hotel .....	47
Atlas Mineral Prod. Co. ....	47	Fuller & Everett. ....	41	Pirnie, Malcolm .....	42
		Fuller & McClintock. ....	41	Potter, Alexander .....	42
Babcock Brothers .....	41				
Barber Asphalt Co. ....	29	General Excavator Co. ....	4	Roberts Filter Mfg. Co. ....	37
Barber-Greene Co. ....	28	Green Co., Howard R. ....	41	Roosevelt Hotel .....	37
Barrett Co., The .....	Back Cover				
Barstow & McCurdy .....	41	Harrub Engineering Co., C. N. ....	42	Shevlin Engineering Co. ....	37
Black & Veatch .....	41	Hill, Nicholas S., Jr. ....	42	Simplex Valve & Meter Co. ....	37
Blaw-Knox Co. ....	26	Hitchings & Co. ....	47	Solvay Sales Corp. ....	2
Browne, Floyd G. ....	41	Innis-Speiden & Co. ....	35	South Bend Foundry Co. ....	38
Buffalo-Springfield Roller Co. ....	30	Jaeger Machine Co. ....	6	Standard Oil Co. (Ind.) ....	24 & 25
Burns & McDonnell Eng. Co. ....	41			Standard Oil Co. of N. Y. ....	27
				Sterling Engine Co. ....	35
Caird, James M. ....	41	Link-Belt Co. ....	40	Sterling Motor Truck Co. ....	6
Calcium-Chloride Assn. ....	2	Littleford Bros. Co. ....	29	Sweets Steel Co. ....	42
Carter Hotel .....	30				
Cleaver-Brooks Co. ....	28	Macmillan Petroleum Corp. ....	6	Taylor, Henry W. ....	42
Cleveland, H. Burdett. ....	41	Metcalf & Eddy. ....	42	Thomas, Edward .....	42
Columbia Alkali Co. ....	2	Michigan Alkali Co. ....	2	Tuthill Spring Co. ....	30
Cramer, Robert .....	41	Mohawk Asphalt Heater Co. ....	4		
				Wiedeman & Singleton. ....	42
Dow, A. W. ....	41	National Paving Brick Assn. ....	6	Woodstock Hotel .....	4
Dow Chemical Co. ....	2				

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS refer to the classified INDUSTRIAL LITERATURE section beginning on page 43 and order by number.

### Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamp-hole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

### Meters, Sewage and Water

405. Just issued. Every sanitary engineer should have a copy of this new 32 page booklet describing the applications, types and distinctive features of the new Bailey meters for sewage treatment and water supply. Sent promptly. Bailey Meter Co., 1027 Ivanhoe Road, Cleveland, Ohio.

### Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

### Screens, Sewage

417. The simple, automatic, Loughlin self-cleaning traveling screen is fully described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

420. A useful new bulletin for all those interested in sewage disposal, describing some of their proven equipment such as self-cleaning bar screens, grit conveyors, sludge collectors and shredders, has just been issued by the Jeffrey Mfg. Co., Columbus, Ohio. Includes diagrams and many illustrations.

### Screens

424. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

### Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

### Sludge Conditioning

381. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

### Treatment

430. Separate bulletins showing their many lines of sewage treatment equipment will be sent promptly by The Pacific Flush Tank Co., Chicago and New York. The latest is No. 110 describing tray clarifiers.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

## Official Advertising

### STATE DEPARTMENT OF PUBLIC WORKS DIVISION OF HIGHWAYS ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m. advanced standard time, which is twelve o'clock noon eastern standard time, on Thursday, May 11, 1933, for the construction of highways in the following Counties:

LIVINGSTON .....	Deposit Required	\$9,000.00
	Miles	
Bit. Mac. Mixing Method Opt. ....	5.87	
Also for the reconstruction of the following:		
	Deposit Required	
ALBANY .....	\$ 5,800	
(Concrete, 2.41 miles)		
SCHENECTADY & SCHOHARIE. ....	7,000	
(Completion—Cons. & Recons.)		
(Gravel, 8.67 miles)		
MADISON .....	3,200	
(Concrete, 0.89 mile)		
ONONDAGA .....	19,000	
(Concrete, 10.01 miles)		

TOMPKINS .....	14,000
(Concrete, 7.64 miles)	
FRANKLIN & ST. LAWRENCE. ....	6,000
(Concrete, 3.44 miles)	
JEFFERSON .....	2,600
(35'-I-Beam bridge, Conc. app., 0.87 mile)	

NASSAU (Cons. & Recons.) ....	9,500
(Bit. Mac. Mixed in place; Grading & Structures, 0.40 mile)	

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of District Engineers in whose districts the roads are located, upon the payment of Five Dollars (\$5.00) for plans and proposal forms. Standard specifications are Two Dollars (\$2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Streets, New York City.

Especially attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement. The amount of the certified check accompanying the proposal of the bidder to whom the contract is awarded will be returned when ten per centum of the work under the contract has been completed. If Surety Bond is dispensed with pursuant to the Highway Law, the amount of the bidding check will be returned when 15% of the contract work has been completed.

The completion contract mentioned above in Schenectady and Schoharie Counties is an Employment Relief Project. The minimum rate for unskilled labor on this contract shall be from forty cents to fifty cents per hour, as specified in the contract, and the minimum rate for skilled labor shall be fifty cents to sixty cents per hour, as specified in this contract. Veterans of the U. S. Military Service with dependents, where qualified to do the work, shall be given preference in employment. No person, except those in supervisory, executive or administrative positions, shall be employed for more than thirty hours in any week. Details of these regulations with respect to preference in employment, use of hand labor, hours of employment, etc. will be found in the itemized proposal.

A. W. BRANDT  
Commissioner of Highways



# LAUGHLIN CLARIFYING TANK

## Low Power and Low Operating Cost

Provides more complete removal of suspended solids from sewage and industrial wastes.

Permits of usual sedimentation and thickening operations within a tank, at high capacity for a given tank size.

Removes solids by positive filtration through a filter bed which extends around entire circumference of tank, extending inwardly five feet or more.

A traveling magnet cleans the filter bed as necessary.

Tanks of round or rectangular type for any capacity.

Low power and low operating cost.

*Write for illustrated folder  
and complete details*

## FILTRATION EQUIPMENT CORPORATION

**350 Madison Ave. New York**



Inspect  
Our  
Installation  
at  
Ithaca  
New York

Glenn D. Holmes  
Consulting  
Engineer  
Syracuse, N. Y.

Send for our Engineers' Folder  
Call on us for plans and specifications

**Hitchings Company**

ELIZABETH, N. J.



## USE MINERALEAD

For Jointing Bell and Spigot  
Water Mains

Easy handling, ingot form—Impervious to moisture—Absolute uniformity—Easy melting—Rapid pouring—No caulking—Less initial leakage—Bell holes unnecessary—A saving in cost of material and labor.

Write for Catalog

**THE ATLAS MINERAL PRODUCTS COMPANY**

of Pennsylvania


MERTZTOWN

Established 1892

PENNSYLVANIA

G-K Sewer Joint Compound

**ON MY WAY TO  
NEW YORK AND  
THE PICCADILLY**



... best hotel I know!  
Near everything, just  
200 feet from Broad-  
way. Modern, hospit-  
able, and comfortable.  
Like the Manager,  
like the rates—\$2.50  
single, \$3.50 double,  
for a room with bath!

**THE HOTEL -  
PICCADILLY**

45th St. • W. of Broadway • New York

WILLIAM MADLUNG, Mng. Dir.

# Barrett Tarvia

GOOD ROADS  
at LOW COST



Hillen Road, Baltimore County, Maryland. Tarvia-built, 1929.

## The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Hartford
Buffalo	Columbus	Milwaukee
Providence	Syracuse	Birmingham
Lebanon	Toledo	Cincinnati
Baltimore	Youngstown	Bethlehem
Rochester	Portland, Me.	

THE BARRETT COMPANY, Ltd.  
Montreal Toronto Winnipeg Vancouver

**P**RACTICAL highway engineers, make your choice . . . An unproved paving product or one backed by America's oldest and most experienced manufacturer of coal-tar road-building materials?

Tarvia may cost slightly more per gallon, but it costs *much less per-year-per-mile-of-road*. For Tarvia is not just an ordinary road material. It is a uniform, dependable product manufactured to rigid specifications in grades exactly suited to every road-building or road-maintaining requirement. It carries with every order Barrett's unmatched delivery and application service, and the helpful cooperation of experienced Tarvia field men.

Above all, Tarvia is assurance of a satisfactory result—smooth, easy-riding, skid-safe road that will give years of low-cost, trouble-free service. Tarvia's 29 year old reputation has been built on that kind of road.

The Tarvia field man will gladly tell you more about Tarvia. 'Phone, wire or write our nearest office.